INSTRUCTION MANUAL

FOR

TYPES SM-9801A AND SM-9802B

SIGNAL MONITORS

COMMUNICATION ELECTRONICS, INC.

6006 EXECUTIVE BOULEVARD ROCKVILLE, MARYLAND, 20852

ADDENDA

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200/M/11/11/66

[redacted]

WARNING

This equipment employs voltages which are dangerous and may be fatal if contacted. Extreme caution should be exercised in working with the equipment with any of the protective covers removed.

ADDENDA

The following changes are required on the schematic diagram, Figure 6-1, and the parts list, paragraph 5.4.2, for the type 8112 IF Amplifier:

(1) Delete R18
(2) Change R22 to 10 Ω, 1/4W, 5% (CB1005)

These modifications change the biasing of field effect transistor A1Q4 so that the voltages given in Table 4-1 for this transistor should be changed as follows:

Source	3.5	Vdc
Gate	0	Vdc
Drain	12	Vdc

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Table 1-1. Types SM-9801A and SM-9802B Signal Monitors, Specifications

Number of Inputs	One, type BNC: Signal Input
Number of Outputs	Two, type BNC: Aux. Vertical and Horizontal Outputs
Input Impedance	50 ohms, nominal
Input Center Frequency	21.4 mc
Range of Center Frequency Control	±200 kc
Flatness of Response	8 mc ± 2 db
Sweep Width	0-8 mc, continuously adjustable
Sweep Linearity	Linear over-all to within 5% of the total sweep width
Sweep Rate	25 cps ± 5 cps
Resolution	Using approximately 100-kc sweep width, two signals 20-kc apart will be displayed with at least a 6-db valley between the peaks
IF Frequencies	13 mc and 1 mc
Oscillator Frequencies:	
1st Local Oscillator	34.4 mc ± 1/2 sweep width
2nd Local Oscillator	14.0 mc
Image Rejection	50 db, minimum
IF Rejection	60 db, minimum
Sensitivity	10 μv input at 21.4 mc produces at least one-inch vertical deflection on the CRT
Gain Control Range	60 db, minimum
Vertical Display Response	Linear
Marker Frequency	21.4 mc ± 0.01%
CRT Display Type	3XP1
Front Panel Controls	Center Frequency, Sweep Width, Gain, Focus, Intensity, Power
Power Input	115/230 volts, 50-400 cps
Power Consumption	6 watts, approximately
Weight	SM-9801A: 8 lbs., approximately SM-9802B: 7 lbs., approximately
Size	SM-9801A: 3.5 inches high, 19 inches wide, and 15.5 inches deep SM-9802B: 3.25 inches high, 7.9 inches wide, and 15.5 inches deep

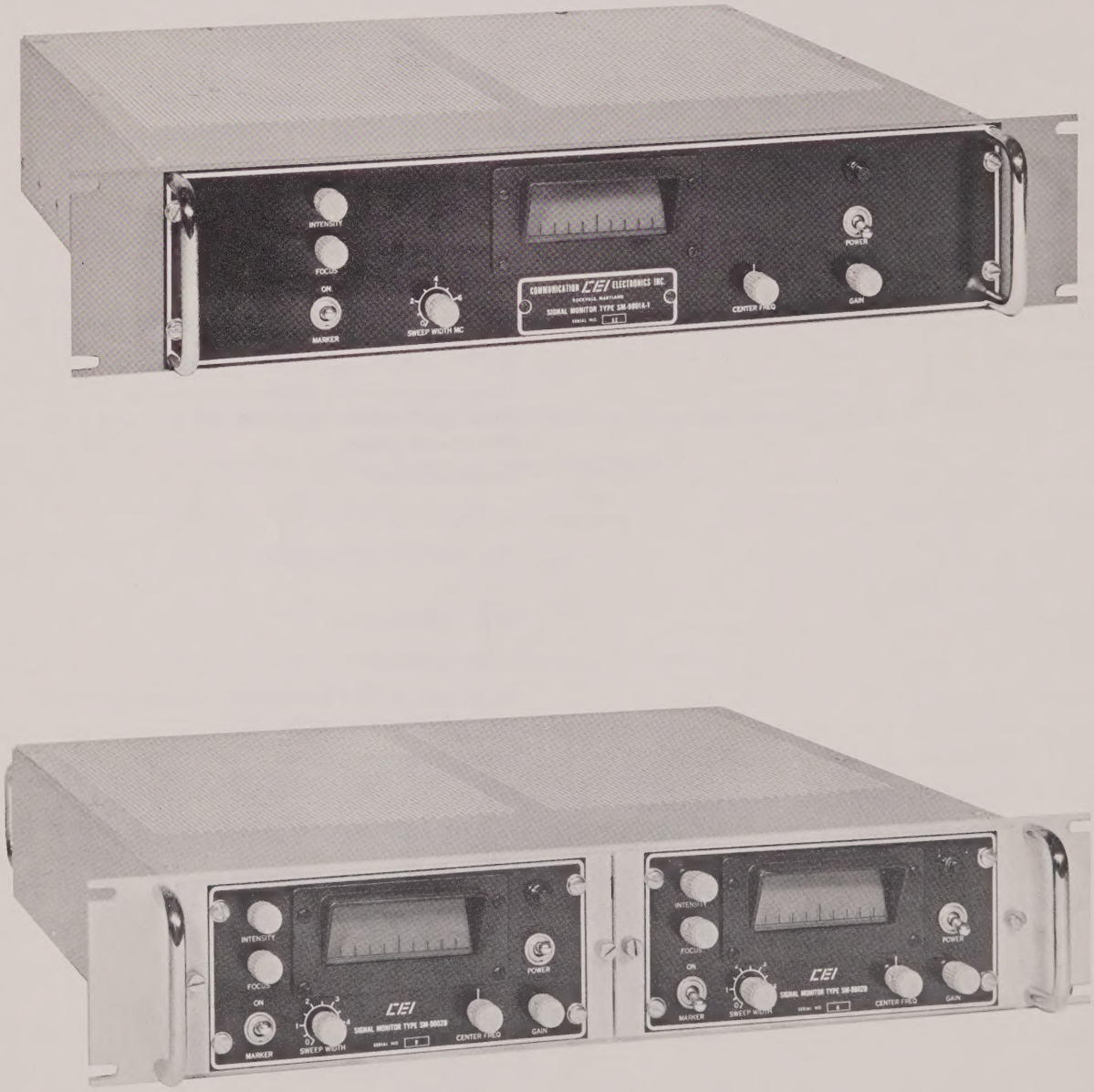


Figure 1-1. Types SM-9801A (top) and SM-9802B (bottom) Signal Monitors, Front Views

SECTION I

GENERAL DESCRIPTION

1.1 GENERAL

This instruction manual has been prepared for the types SM-9801A and SM-9802B Signal Monitors. These two units are electrically identical, therefore, this manual is applicable to either unit from an electrical standpoint. Mechanically, the type SM-9801A is constructed in a 3.5-inch high by 19-inch wide panel (Figure 1-1, top) while the SM-9802B is constructed as a half-rack slide-in unit. The unit in Figure 1-1 bottom consists of two SM-9802B Signal Monitors installed in a type EF-201A Equipment Frame.

1.2 ELECTRICAL CHARACTERISTICS

The type SM-9801A Signal Monitor (or SM-9802B) is used with an appropriate receiver to provide a visual display of the signals present at or near the frequency to which the receiver is tuned. Such a display is an aid in analyzing signals intercepted by the receiver, and can be used to determine such things as the frequency, amplitude and type of modulation. The signal monitor is designed for use with a receiver having an IF frequency of 21.4 mc and a bandwidth of at least 8 mc. It displays signals within a frequency spectrum continuously adjustable from 0 to 8 mc, centered at the frequency to which the receiver is tuned. The sensitivity of the unit is such that a 10 microvolt signal at the input will produce at least a one inch vertical deflection of the signal trace on the screen of the CRT. The resolution is such that two signals 20 kc apart appear on the screen as separate traces with at least a 6 db valley between them. The power supply voltages are regulated to provide stable operation independent of line voltage fluctuations. The signal monitor uses all solid state devices except for the cathode ray tube. The performance specifications are listed in Table 1-1; the tube and transistor complement is presented in Table 1-2.

1.3 MECHANICAL CHARACTERISTICS

The front panel (see Figure 1-1) mounts all of the controls used during normal operation. Additional controls which require infrequent adjustment are located internally. The front panel controls are: CENTER FREQ, SWEEP WIDTH, GAIN, MARKER, INTENSITY, FOCUS, POWER and a pilot light. Located in the center of the front panel is the CRT screen with a green plexiglass overlay.

1.3.1 Mounted on the rear apron of the chassis (see Figure 1-2) are the 115/230 vac slide switch, fuseholders F1 and F2, and three type BNC connectors: Signal Input, J1; Vert Output, J2; and Horiz Output, J3. The power cord is permanently connected through the rear apron.

1.3.2 The front panel, main chassis, and dust covers (on the SM-9801A) are constructed of aluminum. The front panel is overlaid with a black-anodized etched plate. The IF amplifier subassembly which mounts on the main chassis is constructed of sliver plated brass which has been gold flashed to prevent tarnishing. Additional modules are constructed on etched circuit boards, some of which plug into the main chassis while others have a permanent type mounting.

Figure 1-2. Type SM-9802B Signal Monitor, Rear View

Table 1-2. Types SM-9801A and SM-9802B Signal Monitors, Transistor and Tube Complement

Symbol	Type	Function
V1	3XP1	CRT
A1Q1	2N3478	Shaping Amplifier
A1Q2	2N3478	Shaping Amplifier
A1Q3	2N3478	Sweep Oscillator
A1Q4	2N3823	1st Mixer
A1Q5	2N3478	1st 13-mc IF Amplifier
A1Q6	2N706	14-mc Oscillator
A1Q7	2N706	2nd Mixer
A1Q8	2N706	1st 1-mc IF Amplifier
A1Q9	2N706	2nd 1-mc IF Amplifier
A1Q10	2N706	1-mc Output Amplifier
A2Q1	2N489	Pulse Generator
A2Q2	2N697	Sawtooth Generator
A2Q3	2N697	Sawtooth Amplifier
A2Q4	2N1925	Sawtooth Amplifier
A5Q1	2N697	Overload Switch
A5Q2	2N2270	Voltage Regulator
A5Q3	2N2270	Voltage Regulator

Figure 2-1

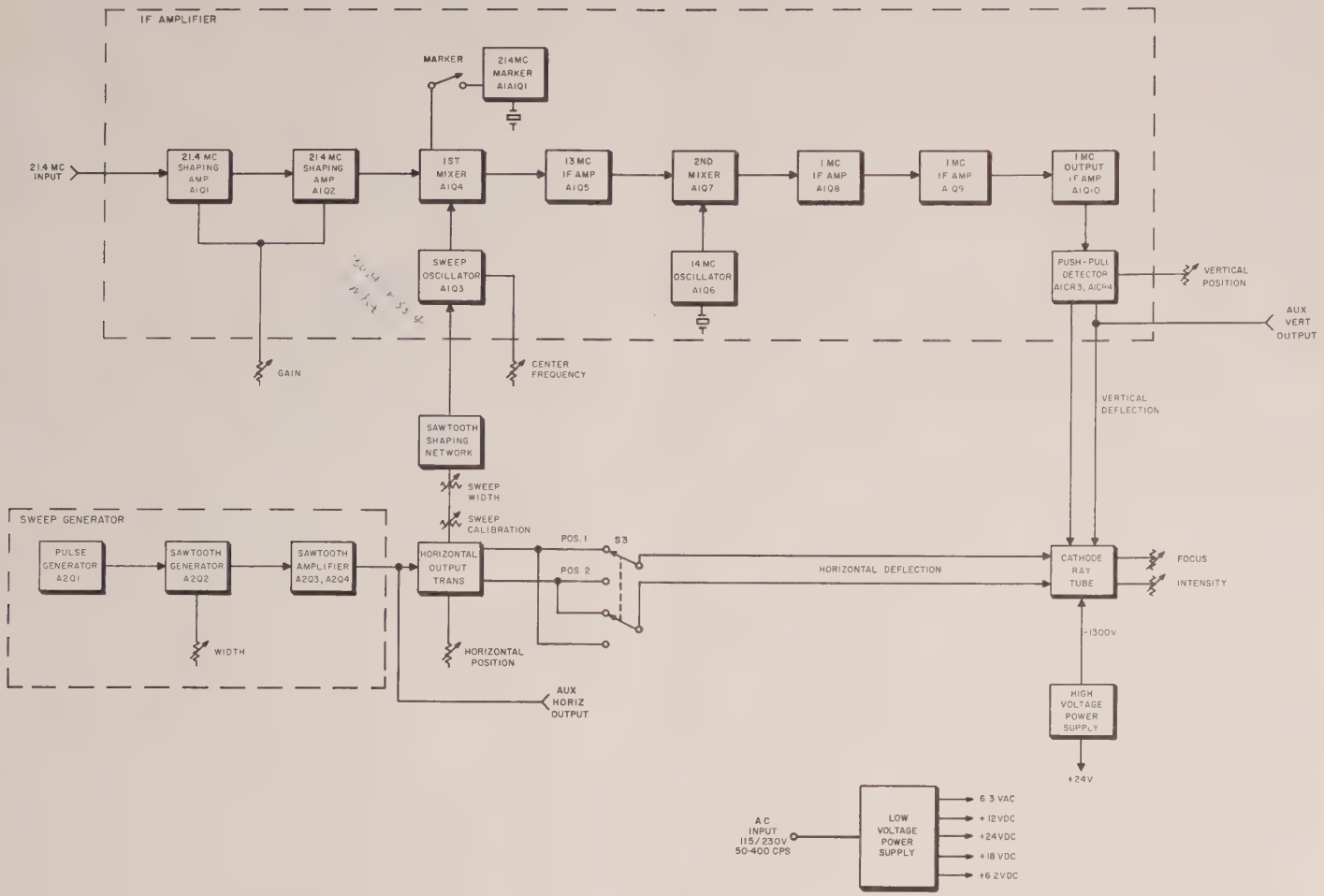


Figure 2-1. Types SM-9801A and SM-9802B Signal Monitors, Functional Block Diagram

SECTION II

CIRCUIT DESCRIPTION

2.1 GENERAL

The operation of the types SM-9801A and SM-9802B Signal Monitors is explained in the following paragraphs using the block diagram, Figure 2-1, and the schematic diagrams included at the back of this manual. These signal monitors can be used to provide a spectral analysis of the 21.4-mc IF signal from any appropriate receiver. An incoming signal level of 10 microvolts within 4.0 mc of this frequency will produce full vertical deflection on the CRT screen. The sweep width is adjustable so that the spectrum being displayed can be adjusted from zero to 8 mc.

2.2 FUNCTIONAL DESCRIPTION

The input signal to the signal monitor is amplified by two shaping amplifiers, A1Q1 and A1Q2, and is applied to the first mixer, A1Q4. The frequency response of the 21.4-mc shaping amplifiers is an essentially flat 8-mc response.

2.2.1 A sawtooth waveform originates in the sweep generator module. The pulse generator, A2Q1, produces a pulse at a 25 ±5 cps rate which is used to trigger sawtooth generator A2Q2. The sawtooth waveform is then amplified in a single ended amplifier (A2Q3 and A2Q4 connected in a complementary configuration) and applied to the horizontal output transformer. The output from the horizontal transformer drives the horizontal deflection plates in the CRT, and a tapped output provides the signal which is shaped by the sawtooth shaping module. The shaped output is then applied to the sweep oscillator, A1Q3. The fact that the waveform which controls the horizontal trace and the sweep generator is derived from a common source explains how synchronization is obtained between the various signals in the incoming RF spectrum and their position on the CRT trace. Control of the CRT trace width is provided by a width potentiometer which operates in conjunction with the sawtooth generator. A horizontal position control, connected in the horizontal output transformer circuit, provides a means of centering the trace on the CRT screen.

2.2.2 The sweep oscillator output is applied to the first mixer, A1Q4, a field effect transistor. The sweep generator has a normal resting frequency of 34.4 mc which is 13 mc higher than the incoming signal. However, using a maximum sweep width, an incoming signal at 17.4 mc and an oscillator frequency of 30.4 mc combine in the mixer to produce 13 mc (the first IF), or an incoming signal of 25.4 mc and an oscillator frequency of 38.4 mc also combine with a resultant of 13 mc. These conditions are noted to explain the relationship between the signal monitor IF, the sweep oscillator frequency, and the position of a signal in the incoming spectrum.

2.2.3 The shaped sawtooth waveform produced in the sawtooth generator section is applied to a varicap modulator in the sweep oscillator section. The capacitance of the varicap changes with changes in amplitude of the impressed sawtooth wave and causes the sweep oscillator to move up and down in frequency in conformance with the sawtooth waveform. Therefore, a 13-mc output is produced from the mixer as the sweep oscillator changes in frequency and differs from a signal in the input spectrum by exactly 13 mc. Since the horizontal movement of the trace on the CRT is controlled by this same sawtooth wave, the signals out of the first mixer ultimately appear as vertical pips across the face of the tube in a position which corresponds to their original position in the input spectrum.

2.2.4 The 13-mc IF signal from the first mixer is amplified by the IF amplifier, A1Q5, and is applied to the second mixer, A1Q7. The output of the crystal-controlled 14-mc oscillator, A1Q6, is also applied to the second mixer. The 1-mc second IF is amplified by the two narrow-band IF amplifiers, A1Q8 and A1Q9, before being applied to the 1-mc output amplifier which drives the push-pull detector. The output from the detector consists of two equal signals of opposite polarity which are applied to the vertical deflection plates of the CRT.

2.2.5 The signal monitor gain is controlled by a front-panel control which varies the gain of the 21.4-mc shaping amplifiers. Controlling the gain of these stages sets the amplitude of the pips on the screen of the CRT. The vertical position of the trace on the CRT screen is adjusted by the vertical position control which functions in conjunction with the push-pull detector circuitry. The marker switch activates the marker oscillator and results in a pip on the CRT screen at exactly the center of the signal monitor response. This facilitates receiver tuning and adjustment of the center frequency control. The center frequency control varies the bias level on the varicap modulator to provide vernier control of the sweep oscillator resting frequency. The sweep direction switch works in

conjunction with the horizontal transformer output to the CRT and provides the capability for the signal monitor to display the spectrum, low frequency to high frequency, from left to right on the trace, regardless of the number of conversions used in the associated receiver before the signal monitor output point.

2.2.6 The power supply is self contained and is designed to operate from a primary power source of 115/230 vac, 50-400 cps. All voltages required by the unit are provided by the power supply.

2.3 IF AMPLIFIER

An explanation of the IF amplifier circuitry is presented in the following paragraphs. Refer to Figure 6-1 as required. The reference designation prefix for this assembly is A1.

2.3.1 21.4-mc Shaping Amplifier. - The 21.4-mc shaping amplifier provides an essentially flat response curve 8-mc wide. The 21.4-mc shaping amplifier consists of two stages, Q1 and Q2. The gain of the signal monitor is controlled by the GAIN control mounted on the front panel which varies the bias level at the bases of these stages through resistive voltage dividers.

2.3.1.1 First Shaping Amplifier. - The input signal is coupled to the base of the first shaping amplifier, Q1, through dc-blocking capacitor C2. Resistor R1 establishes the input impedance of the signal monitor. Capacitor C18 and inductor L2 form a series-tuned resonant trap at 13 mc, the first IF frequency, to improve the IF rejection. Neutralization is accomplished by feeding a small out-of-phase signal from the single-tuned collector circuit back to the base through capacitor C3. The output signal from Q1 is coupled to the second shaping amplifier, Q2, through an impedance-matching capacitive voltage divider consisting of C5 and C6.

2.3.1.2 Second Shaping Amplifier. - The output of the second shaping amplifier, Q2, is coupled through a double-tuned over-coupled circuit to the base of the first mixer, Q4. Neutralization is accomplished by feeding a small out-of-phase signal from the first section of the double-tuned circuit to the base of Q2 through capacitor C9. The double-tuned response combines with the single-tuned response of Q1 to produce an essentially flat, 8-mc wide, response curve at the output of the shaping amplifiers. A detector circuit including a test point is connected to the second section of the double-tuned circuit to provide a means of checking alignment and signal levels at this point.

2.3.2 Sweep Oscillator. - The sweep oscillator, Q3, is basically a Colpitts circuit with its output frequency swept across a maximum range of 8 mc. The oscillator center frequency is 34.4 mc. The frequency variation is controlled by the varicap, CR2, whose capacitance varies with the voltage applied across its terminals. This varicap is connected in series with the oscillator tank circuit and controls the oscillator frequency by varying the series capacitance. The bias voltage for the varicap is applied through feedthru capacitor C17 from the CENTER FREQ potentiometer, R1. The varying voltage applied to the anode terminal of the varicap has a modified sawtooth waveform. The sawtooth voltage is derived from a tap on the horizontal transformer and is fed through the sweep calibration control, A4R1, and the front-panel mounted SWEEP WIDTH control, R5, to the sawtooth shaping network. The sawtooth shaping network in effect distorts the linear sawtooth waveform to compensate for the nonlinearity of changes in capacity of the varicap with the applied voltage. By making the sawtooth voltage change at a nonlinear rate, the sweep oscillator frequency is made to vary at a linear rate. The output of the sweep oscillator is taken from the junction of C16 and L6 and applied to the gate of the first mixer.

2.3.3 First Mixer and 13-mc IF Amplifier. - The first mixer, Q4, beats the input signal from the shaping amplifier with the sweep oscillator signal to produce the 13-mc first IF frequency. A field effect transistor is used as the first mixer to take advantage of the almost perfect square-law characteristics of the device, so that the generation of spurious signals in the mixing action is minimized. The mixer output is coupled through a double-tuned circuit to the base of the first IF amplifier, Q5. The output of Q5 is coupled through a double-tuned circuit to the second mixer, Q7.

2.3.4 14-mc Oscillator. - The 14-mc oscillator, Q6, is a crystal-controlled Colpitts oscillator. The output signal is taken from the base and injected through capacitor C36 in the double-tuned coupling circuit between the first IF amplifier, Q5, and the second mixer, Q7.

2.3.5 Second Mixer. - The second mixer, Q7, receives the 13-mc IF signal and the 14-mc oscillator signal at its base. The mixer beats these signals to produce the 1-mc second IF frequency. The 1-mc signal is coupled through a double-tuned circuit to the base of the first 1-mc IF amplifier, Q8.

2.3.6 1-mc IF Amplifier. - The 1-mc IF amplifiers, Q8 and Q9, are narrow-band amplifiers which provide additional amplification to the 1-mc IF signal from the second mixer and the selectivity necessary for good resolution. The bandwidth at the output of the 1-mc IF amplifiers is 20 kc. The output signal from Q9 is coupled to the base of the output amplifier, Q10.

2.3.7 Output Amplifier and Push-Pull Detector. - The output of the output amplifier is fed to a tap on the tuned circuit (L17-C61) to provide a step up in signal voltage. The stepped-up signal voltage is coupled to the push-pull detector, CR3 and CR4. The push-pull detector produces two signals of equal amplitude but of opposite polarity. The positive output is taken from diode CR3 through R50 and C64 and applied to one vertical deflection plate in the CRT; the negative output is taken from diode CR4 through R51 and C66 and fed to the other vertical deflection plate. A voltage is connected from the vertical position control, A4R7 through C67, R49, R51 and C66 to one of the deflection plates to provide vertical positioning of the trace on the CRT screen. In addition, a portion of the detected output signal from diode CR3 is taken from the voltage divider, R47 and R48, and connected through C65 to the VERT OUTPUT jack J1 on the rear apron.

2.3.8 Marker Oscillator. - The marker oscillator provides a reference pip on the CRT trace to indicate the center of the signal monitor bandpass. The marker oscillator is contained in a shielded module mounted on the IF amplifier chassis. The marker oscillator is crystal controlled and operates at 21.4 mc. The output of the oscillator is applied to the base of the first mixer. It is activated by the marker toggle switch mounted on the front panel which connects +12 volts through C31 to the collector of A1Q1.

2.4 SWEEP GENERATOR

The type 8208 sweep generator schematic diagram is shown in Figure 6-2; the reference designation prefix is A2. The output voltage of the sweep generator has a sawtooth waveform. Capacitor C1 charges from the +24 volt supply through R1 to a level sufficient to trigger the unijunction transistor Q1. The discharge of C1 through the emitter-base one junction of Q1 and R3 produces a positive pulse which passes through CR1 to the base of Q2, turning this stage on. Capacitor C2 rapidly discharges through Q2 placing the base of Q4 near ground which causes this stage to conduct hard momentarily, charging C3. This creates the trailing edge of the sawtooth waveform. The pulse at the base of Q2 lapses and this stage cuts off. Capacitor C2 begins to charge through R5, R6, R7 and CR2. The charging voltage is reflected through CR2 to the base of Q3 and this stage begins to conduct harder. The emitter of Q3 follows the rising voltage at its base to create the rising portion of the sawtooth waveform. Bootstrapping capacitor C3 also discharges through Q3 linearizing the slope of the sawtooth waveform. The repetition rate of the sweep generator is established by the RC time constant of C1 and R1. The output through C4 is connected to the horizontal output transformer. Potentiometer R6 determines the amplitude of the sawtooth generated, and thus the width of the horizontal sweep.

2.5 CONTROL BOARD

The type 7959 control board schematic diagram is shown in Figure 6-3; the reference designation prefix is A4. The control board is an etched, plug-in type circuit board which mounts the horizontal output transformer and associated circuitry, and various calibration controls.

2.5.1 The output of the sweep generator is connected to the autotransformer-type horizontal output transformer, T1. The horizontal output is taken from T1 and connected through the sweep direction switch, S3, to the horizontal output shaping networks. The two shaping networks consist of: C3, R11 and R12; C4, R13 and R14. The shaping networks provide better linearity in the horizontal sweep. The horizontal position control, R4, provides for centering the horizontal trace on the CRT screen. Main chassis switch S3 reverses the phase of the horizontal output to allow a left-to-right (low frequency to high frequency) spectrum display regardless of the number of conversions in the receiver prior to the signal monitor output point. The output from the shaping networks is connected to the horizontal deflection plates in the CRT. An additional output is taken from the input to T1 and connected through isolation resistor R10 to the auxiliary Horiz Output jack J3 located on the rear apron. The sweep oscillator input signal is taken from a tap on T1 and passes through the sweep calibration control, R1, and through Sweep Width control R5 located on the front panel, before being applied to the sawtooth shaping network.

2.5.2 The vertical position control, R6, derives a voltage from the +24 volt supply which is applied through A1C67, A1R49, A1R51 and A1C66 to one of the vertical deflection plates in the CRT to provide a means of locating the vertical position of the trace on the CRT screen. The marker control, R9, derives a voltage from the +12 volt supply which is used to power the marker oscillator when the front-panel MARKER switch is turned on. Adjusting

the voltage to the marker oscillator controls the amplitude of the oscillator output and ultimately the amplitude of the marker pip on the screen of the CRT.

2.6 POWER SUPPLY

The primary power required is 115/230 vac, 50-400 cps. The line input (see Figure 6-5) is connected through the fuse, F1, and the power switch, S1, to the primary winding of the power transformer, T1. The 115/230 vac switch, S4, is mounted on the rear apron of the main chassis and connects the two primary windings either in parallel or series for 115 or 230 vac input power, respectively. When S4 is in the 230 vac position, the fuse, F2, is connected into the circuit. One secondary winding, 5-6, provides 6.3 vac for the filaments in the CRT. The other secondary winding, 7-8-9, provides the input power for the power supply module.

2.6.1 Low Voltage Power Supply. - The type 7652 power supply schematic diagram is shown in Figure 6-4; its reference designation prefix is A5. The power supply is constructed on a plug-in type etched circuit board. The diodes CR1 and CR2 form a full-wave rectifier to provide the input dc power to the series voltage regulator, Q2. Zener diode CR4 is biased through R1, R2, and CR3 from the input voltage. The Zener maintains a fixed voltage on the base of Q2 to maintain the output voltage constant. Diode CR3 provides temperature compensation for the Zener to maintain the Zener voltage constant with changes in temperature. When a current overload occurs, the increased voltage drop across R3 biases on the overload protection stage Q1 which shunts the current to CR4 and the Zener drops out of regulation. This causes the base voltage of Q2 to drop, thereby limiting the current through Q2 and preventing its destruction through over-dissipation. Resistor R7 operates in conjunction with the Zener diodes, CR5 and CR6, to provide regulated 18 volt and 6.2 volt sources from the +24 volt supply. Series regulator Q3 receives its input power from the +24 volt supply output through the dropping resistor R5. The Zener diode CR8 is biased through R4, R6 and the temperature compensating diode CR7. The +12 volt regulating circuit functions identically to the +24 volt regulator described above.

2.6.2 High Voltage Power Supply. - The high voltage power supply, PS1, provides the high voltage required by the CRT. It is a dc-to-dc converter contained in a sealed module mounted on the main chassis. The input power is from the +24 volt supply and the output voltage is -1300 volts.

2.7 CATHODE RAY TUBE

The CRT, V1, provides a visual display of the input signal spectrum. The CRT has a rectangular face with a green plexiglass overlay which is inscribed with a horizontal base line, a vertical center marker, and five smaller vertical markers on each side of the center. These marks are not calibrated in any specific units but are provided for reference purposes only. The -1300 volt output from the power supply, PS1, is applied to the control grid and to a voltage divider consisting of R6, R7, R8, R9, R10, and R11. The voltage divider provides reduced voltage outputs for the various CRT operating functions. The intensity of the light beam on the face of the CRT is adjusted by the INTENSITY control, R7, which varies the accelerator voltage applied to the cathode. The FOCUS control, R9, is utilized to obtain a sharp waveform on the CRT screen by varying the potential on the focusing element.

SECTION III

INSTALLATION AND OPERATION

3.1 INSTALLATION

The SM-9801A mounts in a standard 19-inch rack with 3.5-inches vertical height and 15-inches depth required. The SM-9802B mounts in a CEI type EF-101 single equipment frame or a type EF-201A dual equipment frame. These frames are designed for installation in a 19-inch rack, and require 3.5-inches vertical height and 15-inches depth. Proper ventilation should be provided for the equipment to prevent unnecessary aging of components.

3.1.1 Power Connection. - Plug the power cord into a 115/230 volt, 50-400 cps source. The third pin of the power cord is used for grounding the unit. If a three-pin receptacle is not available, use the three-to-two pin adapter provided. Position the 115/230 switch on the rear apron to correspond with the line voltage used.

3.1.2 Receiver Connection. - Connect the signal monitor input to the receiver signal monitor output using mating plugs and 50-ohm coaxial cable.

3.2 OPERATION

The use of the operating controls is explained in the following paragraphs. These controls are shown in the front view, Figure 1-1, or in the top view, Figure 5-1.

3.2.1 Power. - The POWER switch applies ac power to the primary of the power supply transformer. The power should be applied several minutes before operation begins to allow for warm-up. A red lamp indicates when the POWER switch is on.

3.2.2 Gain. - The GAIN control varies the height of the pips displayed on the CRT. Adjust this control as necessary to maintain the desired height of the display.

3.2.3 Marker. - When used, the MARKER switch results in a pip on the CRT screen at 21.4 mc. This pip indicates the center of the signal monitor response.

3.2.4 Focus. - The FOCUS control provides a means for obtaining a sharp trace on the face of the CRT.

3.2.5 Intensity. - The INTENSITY control varies the brightness of the trace on the CRT.

3.2.6 Sweep Width. - The SWEEP WIDTH control varies the width of the frequency spectrum being viewed. When this control is in the maximum clockwise position, a maximum bandwidth (8 mc) is being displayed.

3.2.7 Center Frequency. - The CENTER FREQUENCY control varies the horizontal position of the pips on the CRT. Under normal operation, use this control to center the frequency spectrum under display on the center mark of the CRT screen.

3.2.8 Sweep Direction Switch. - The sweep direction switch reverses the spectrum display on the CRT. Observing the signal monitor display, tune the associated receiver higher in frequency. Intercepted signals should first appear at the right-hand end of the trace and move to the left. If signals appear at the left-hand end of the trace and move to the right, change the position of the sweep direction switch.

3.3 INTERPRETATION OF SIGNALS

The following list is presented as a guide for interpretation of various signals and waveforms that might appear on the CRT.

(1) An unmodulated carrier without noise or random disturbances will appear as a deflection with fixed height.

(2) A carrier that is amplitude modulated will appear as a deflection of variable height. If the modulation rate is high, sidebands may appear.

(3) A single-tone-modulated FM signal will appear as a group of spikes corresponding to the center frequency and the sidebands.

(4) Noise appears as varying irregularities or "grass" along the base line and may be eliminated by a reduction of the GAIN control setting.

SECTION IV

MAINTENANCE

4.1 GENERAL

The SM-9801A and SM-9802B Signal Monitors are designed to give trouble-free performance, present no special maintenance problems, and normally require no care beyond being kept clean. Should trouble occur, it is important that maintenance be performed by trained technicians familiar with Section II, in which the circuits are described. In addition, they should use Figures 6-1 to 6-5, the schematic diagrams, and Table 4-1 in which the pin socket voltages are listed. Field maintenance should be confined to cleaning and replacement of the fuses, semiconductors, CRT, or plug-in modules. All other maintenance and repair work should be carried on in a well-equipped shop and performed only by trained and experienced personnel.

4.2 CRT REMOVAL

To remove the CRT, first remove the bezel by taking out the four front panel screws. After this the tube can be drawn out of the equipment. If this seems difficult, apply a slight pressure against the center pin of the tube by pushing with a blunt instrument through the center hole of the CRT socket.

4.3 MODULE REMOVAL

The plug-in modules can be easily removed by pulling them out of the receptacles into which they are fitted after first holding the retaining brackets aside. The numbers on the pins coming out of the modules correspond to the numbers indicated on the schematic diagram.

4.4 TROUBLESHOOTING

The greatest percentage of troubles will be caused by failures of the fuse, CRT, or the semiconductors. The proper functioning of all these parts should be assured either by test or by replacement with parts known to be good before any further troubleshooting is carried out. Initial troubleshooting should be directed toward localizing the problem to a specific portion of the signal monitor. The power supply should always be one of the first circuits suspected, and voltage measurements should be taken to assure its proper functioning before other circuits are checked. Once the power supply is known to be operating properly, an oscilloscope can be used effectively to trace a defect to a plug-in module, or the plug-in modules can be easily replaced with spares known to be good, thus quickly checking an entire module. The IF amplifier is most easily checked using the signal injection method, starting near the output and working back toward the input. Tables 4-2 and 4-3 have been included to furnish a guide for trouble localization; they are intended to illustrate methods which may be used in more detailed troubleshooting procedures.

WARNING

Due to the extremely high voltage present at the output of PS1, special care should always be taken to discharge it prior to carrying out any work on the chassis underside. Do not rely on the bleeder circuit. An open circuit may have occurred which leaves it charged with a lethal voltage.

4.5 ALIGNMENT

The alignment procedures listed are suitable for use in the field when making periodic performance checks, or when making adjustments after replacing tubes or components. The alignment of the signal monitor should be performed only with suitable equipments by technicians thoroughly familiar with their use.

4.5.1 Use of Marker During Alignment. - A post-detection type marker adder is recommended, and the alignment procedures in this book assume that one is used. However, if such a marker adder is not available, the marker

generator output should be loosely coupled to the sweep generator output. This can be done by connecting the marker signal source to a turn or two of insulated wire wrapped around the sweep generator lead near the point of connection to the circuit under test or by coupling to the sweep generator lead through a small capacitor. To insure that the addition of the marker is not affecting the response curve, disconnect the marker generator and observe that no change in the curve's shape or symmetry occurs.

4.5.2 Use of Oscilloscope During Alignment. - The vertical and horizontal amplifier inputs on the oscilloscope should be set in the dc-coupled mode. The dc component of the signal on the vertical input should be cancelled out by applying an equal voltage to the unused vertical differential scope input, since the dc component sometimes makes it impossible to center the signal vertically. Otherwise it will sometimes be necessary to use the ac-coupled mode. A low-capacity shielded cable should be used to connect to the oscilloscope, and the shield should be grounded as closely as possible to the point to which the center conductor is connected.

4.5.3 Equipments Required. - The following equipments, or their equivalents, are required to perform the complete receiver alignment:

(1) Oscilloscope, Tektronix Type 503

(2) VTVM, RCA Type WV-98B

(3) Signal Generator, Hewlett Packard 606A

(4) Sweep Generator, Telonic Model SM-2000 with Type LH2 plug-in head

(5) Assorted cables, connectors, and alignment tools

4.6 IF AMPLIFIER ALIGNMENT

The IF amplifier alignment is presented in the following paragraphs. Refer to Figures 6-1 and 6-5 as necessary.

4.6.1 Initial Control Settings. - Begin the alignment by adjusting the controls as follows. After the initial preset, do not change position of any control unless instructed to do so.

(1) CENTER FREQ control at midrange.

(2) SWEEP WIDTH control fully counterclockwise.

(3) GAIN control fully counterclockwise.

(4) INTENSITY control for visible trace.

(5) FOCUS control for fine definition of trace.

(6) Vert Pos control for positioning of trace coincident with black base line.

4.6.2 1-mc and 13-mc IF Alignment. - Proceed as follows:

(1) Turn on the signal monitor.

(2) Remove A1Y1, 14-mc crystal, from its socket.

(3) Connect the signal generator output to the junction of A1C35 and A1L11.

(4) Adjust the signal generator frequency to exactly 1.0 megacycle.

(5) Reducing signal generator output as necessary, adjust A1L12, A1L13, A1L14, A1L15, A1L16, and A1L17 for maximum upward deflection of the sweep trace on the CRT.

(6) Replace A1Y1.

(7) Connect the signal generator output to the junction of A1C15 and A1L7.

(8) Adjust the signal generator frequency to exactly 13.0 megacycles.

(9) Reducing signal generator output as necessary, adjust A1L8, A1L9, A1L10, and A1L11 for maximum upward deflection of the sweep trace on the CRT.

4.6.3 21.4-mc Shaping Amplifier Alignment. - Proceed as follows:

(1) Set up the equipment as shown in Figure 4-1.

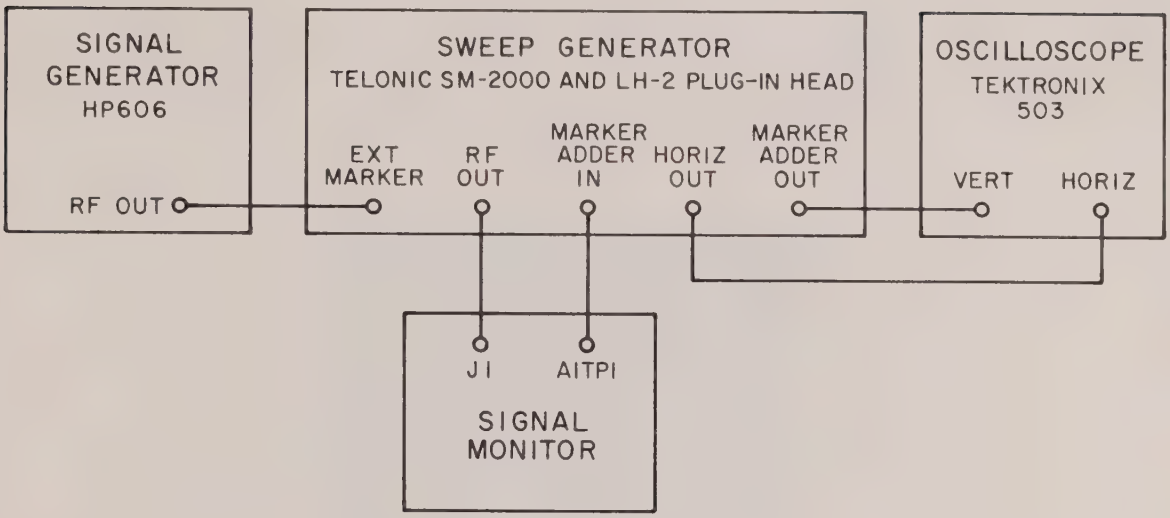


Figure 4-1. Test Equipment Setup, Shaping Amplifier Alignment

(2) Calibrate the signal generator to produce a 21.4-mc marker signal.

(3) Set the oscilloscope horizontal amplifier to sweep disabled.

(4) Set oscilloscope vertical sensitivity to 20 mv per cm and the horizontal sensitivity as required to produce a trace 10-cm wide.

(5) Set the GAIN control on the signal monitor fully clockwise.

(6) Adjust the sweep generator output level, sweep width and sweep frequency until a response curve is displayed on the oscilloscope.

(7) Adjust A1L1, A1L4, and A1L7 for a response similar to the one shown in Figure 4-2. The center mark is at 21.4 mc while the bandwidth markers are at 17.4 mc and 25.4 mc.

4.6.4 13-mc Trap Alignment. - Proceed as follows:

(1) Connect signal generator to SIGNAL INPUT J1 on signal monitor; set generator output frequency to 13 mc.

(2) Set signal monitor GAIN control to maximum clockwise position.

(3) Increase output level of signal generator for maximum upward deflection of sweep trace on the CRT.

(4) Adjust A1L2 for minimum upward deflection of sweep trace.

4.7 SWEEP OSCILLATOR ALIGNMENT AND CONTROL ADJUSTMENTS

The sweep oscillator and the chassis controls are usually adjusted and aligned together, since some interaction is present.

4.7.1 Initial Control Settings. - Begin the adjustment by setting the controls as follows:

(1) CENTER FREQ control at midrange.

(2) SWEEP WIDTH control fully clockwise.

(3) GAIN control fully clockwise.

(4) INTENSITY control for visible trace.

(5) FOCUS control for fine definition of trace.

(6) Vert Pos control for positioning of trace coincident with black base line.

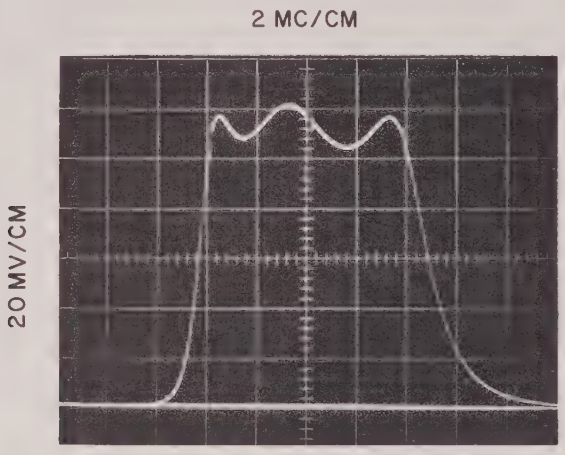


Figure 4-2. Response Curve, Shaping Amplifier

4.7.2 Sweep Oscillator Alignment and Marker Alignment. - Proceed as follows:

(1) Turn on the signal monitor 21.4-mc marker oscillator.

(2) Adjust A1L6 for alignment of the marker signal at the center of the trace.

(3) Adjust the SWEEP WIDTH control to the fully counterclockwise position.

(4) Adjust A1L6 for maximum vertical deflection of the trace.

(5) Set the Marker adjustment, A4R9, for full scale (1 inch) vertical deflection of the trace.

(6) Turn off marker oscillator.

4.7.3 Horizontal Position, Width and Sweep Calibration Adjustment. - Proceed as follows:

(1) Set the SWEEP WIDTH control to the fully clockwise position.

(2) Connect the signal generator to the SIGNAL INPUT, J1.

(3) Adjust the signal generator frequency to exactly 21.4 mc.

(4) Adjust the signal generator output level for a signal of full-scale deflection on the CRT.

(5) Set the Horiz Pos adjustment, A4R4, so that the signal is centered on the mid-point marker on the CRT screen.

(6) Observe the CRT horizontal trace. It should reach across the full width of the screen but at least one end should be barely visible. If not, set the Width adjustment, A2R6, until the trace appears as described. Recheck the setting of the Horiz Pos adjustment.

(7) Increase the frequency of the applied signal precisely 4 mc. The signal should be aligned with the vertical marker at one end of the base line. If not, vary the Sweep Cal adjustment until it does. The setting should be checked by decreasing the signal generator frequency exactly 8.0 mc, in which case the signal should fall approximately at the vertical marker at the other end of the base line.

Table 4-1. Tube, Transistor and Module Pin Voltages

Ref. Desig.	Type	1	2	3	4	5	6	7	8	9
V1	3XP1	8.8	10.8	-1120**	-1140	-600	8.8	0.1	-1120**	GND

Ref. Desig.	Type	Transistor Elements			
		Emitter	Base	Collector	Other
A1Q1	2N3478	1.4	2.1	9.0	GND
A1Q2	2N3478	1.35	2.0	11.2	GND
A1Q3	2N3478	5.7	6.0	10.0	GND
A1Q4	2N3823	3.8(S)	2.4(G)	9.0(D)	GND
A1Q5	2N3478	2.4	3.0	10.0	GND
A1Q6	2N706	3.8	3.1	7.3	---
A1Q7	2N706	2.4	3.0	10.0	---
A1Q8	2N706	2.4	3.0	10.0	---
A1Q9	2N706	2.4	3.0	10.0	---
A1Q10	2N706	1.8	2.5	10.8	---

Sweep Generator Module (A2) Pin Numbers

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
NC	17*	NC	NC	NC	NC	NC	NC	NC	24	NC	NC	NC	GND	NC	NC	NC	NC

Control Board Module (A4) Pin Numbers

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
56* 8.8	92*	NC	15*	25*	98*	16*	100*	92*	24	57* 10.8	10.5	0	0	GND	NC	NC	NC

Power Supply Module (A5) Pin Numbers

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
GND	25 ac	25 ac	NC	NC	NC	NC	NC	NC	NC	NC	0	6.2	NC	24	NC	12	GND

NOTES: All readings taken with 115 volt, 60 cps primary power, front panel controls fully clockwise and no signal input. All voltages are positive direct current measured with respect to ground unless otherwise indicated. The high voltage measurements are made using a high impedance high voltage probe. The sawtooth voltage measurements are made using a Tektronix model 503 oscilloscope. All other readings are made using an RCA WV-98B VTVM.

* Sawtooth voltages measured peak to peak.
** V1 pin 3 to 8 potential is 6.3 vac (filament).

(S) Source
(D) Drain
(G) Gate

Table 4-2. Types SM-9801A and SM-9802B Signal Monitors, Troubleshooting Chart

SYMPTOM	PROBABLE CAUSE	REMEDY
Unit completely inoperative.	a. Blown fuse.	a. Replace F1. If fuse blows immediately, check for short circuit.
	b. No ac input.	b. Check ac connection to receptacle.
Unit operative, pilot light out.	a. Defective lamp.	a. Replace lamp.
CRT blank.	a. Defective power supply module.	a. Check plus 24-volt output. Replace module or locate defective component.
	b. Defective power transformer.	b. Check windings for continuity. Replace if necessary.
	c. Defective high voltage power supply PS1.	c. Measure PS1 output using a high voltage, high impedance probe.
	d. Open resistor R6 or R7.	d. Check resistances.
	e. Defective CRT.	e. Replace CRT.
No horizontal trace.	a. Sweep generator module defective.	a. Check auxiliary horizontal output. Replace module or locate defective component.
	b. Control board module defective.	b. Replace module or locate defective component.
No vertical trace with input signal applied.	a. Defective cable or connection.	a. Check cable and plugs for continuity.
	b. Plus 12-volt portion of power supply defective.	b. Check voltage at A1C59. Locate and replace faulty component.
	c. Defective IF amplifier subassembly.	c. See IF amplifier troubleshooting chart (Table 4-3).

Table 4-2. Types SM-9801A and SM-9802B Signal Monitors, Troubleshooting Chart - (Cont'd)

SYMPTOM	PROBABLE CAUSE	REMEDY
Low amplitude vertical deflection.	a. Defective IF transistor b. Diode A1CR3 or A1CR4 defective c. Misalignment.	a. Check and replace as necessary. b. Check and replace if necessary. c. Realign.
Intensity high, focus control poor.	a. Capacitor C4 defective.	a. Replace C4.
Focus control inoperative.	a. Open resistor, R8, R9, R10 or R11.	a. Check resistances.
Center Frequency control inoperative.	a. Plus 6.2 volt portion of power supply defective.	a. Check voltage at A1C17. Locate and replace faulty component.
No marker pip displayed when marker switch pressed.	a. Marker switch or marker amplitude control, A4R9, defective. b. Marker oscillator defective.	a. Check voltage at A1C31. Replace defective part. b. Locate and replace faulty component.

Table 4-3. IF Amplifier, Troubleshooting Chart

Procedure: This troubleshooting chart uses the signal injection method. A signal generator covering the frequency range of 1-21.4 mc is required. Adjust the signal generator to the specified frequencies. Connect the signal generator output to the various injection points and observe the CRT screen for a signal display. The signal display produced by a signal at the IF frequencies (1 mc and 13 mc) will not be a pip but will result in an upward shift of the sweep trace.

SYMPTOM	PROBABLE CAUSE	REMEDY
No base line shift with 1-mc signal injected at the junction of A1C39 and A1L11.	a. Defective transistor A1Q7, A1Q8, A1Q9 or A1Q10.	a. Check and replace if necessary.
No base line shift with 13-mc signal injected at the junction of A1C33 and A1L11.	a. Defective transistor A1Q6 or crystal Y1.	a. Check and replace if necessary.
No base line shift with 13-mc signal injected at the junction of A1C15 and A1L7.	a. Defective transistor A1Q4 or A1Q5.	a. Check and replace if necessary.
No pip displayed on CRT with 21.4-mc signal injected at the junction of A1C15 and A1L7.	a. Defective transistor A1Q3. b. Defective voltage variable capacitor A1CR2.	a. Check and replace if necessary. b. Vary signal generator frequency around 21.4 mc. If a base line shift is observed, check for sawtooth voltage at A1C68. If sawtooth voltage is present, replace A1CR2.
No pip displayed on CRT with 21.4 mc signal injected at jack A1J1.	a. No bias voltage. b. Defective transistor A1Q1 or A1Q2.	a. Check voltage at A1C1. Check and replace faulty GAIN control. b. Check and replace if necessary.

SECTION V

REPLACEMENT PARTS LIST

5.1 UNIT NUMBERING METHOD

The unit numbering method of assigning reference designations (electrical symbol numbers) has been used to identify assemblies, subassemblies (and modules), and parts. An example of the unit method follows:

Read from right to left as: First (1) resistor (R) of first (1) subassembly (A)

As shown on the main chassis schematic, components which are an integral part of the main chassis have no subassembly designation.

5.2 REFERENCE DESIGNATION PREFIX

Partial reference designations have been used on the equipment and on the illustrations in this manual. The partial reference designations consist of the class letter(s) and identifying item number. The complete reference designations may be obtained by placing the proper prefix before the partial reference designations. Prefixes are provided on drawings and illustrations following the notation "REF DESIG PREFIX".

5.3 LIST OF MANUFACTURERS

Vendor Code	Name and Address
01121	Allen-Bradley Company 136 West Greenfield Avenue Milwaukee, Wisconsin
01281	TRW Semiconductors, Inc. Lawndale, California
02567	International Electronic Industries Nashville, Tennessee
04013	Taurus Corporation 8 Coryell Street Lambertville, New Jersey
06001	General Electric Capacitor Division Irmo, South Carolina
07688	Joint Electron Device Engineering Council Washington, D. C.
14632	Communication Electronics, Inc. 6006 Executive Boulevard Rockville, Maryland
15605	Cutler-Hammer, Inc. 321 North 12th Street Milwaukee, Wisconsin
26655	TRW Capacitor Division Thompson Ramo Woolridge, Inc. 112 West First Street Ogallala, Nebraska
42190	The Muter Company 1255 South Michigan Avenue Chicago, Illinois
56289	Sprague Electric Company 91 Marshall Street North Adams, Massachusetts
71279	Cambridge Thermionic Corporation 455 Concord Avenue Cambridge, Massachusetts
71400	Bussman Manufacturing Company University at Jefferson Street St. Louis, Missouri
71450	Chicago Telephone Supply Corporation 1142 West Beardsley Avenue Elkhart, Indiana

Vendor Code	Name and Address
71700	Cornish Wire Company 50 Church Street New York, New York
72136	Electro Motive Manufacturing Company South Park and John Streets Willimantic, Connecticut
72619	Dialight Corporation 61 Stewart Avenue Brooklyn, New York
72982	Erie Technological Products, Inc. 644 West 12th Street Erie, Pennsylvania
74306	Piezo Crystal Company 265 East Pomfret Street Carlisle, Pennsylvania
74868	Amphenol RF Division 33 East Franklin Street Danbury, Connecticut
75915	Littelfuse, Incorporated 1865 Miner Street Des Plaines, Illinois
76055	Mallory Controls Company Box 231 Frankfort, Indiana
79727	Continental-Wirt Electronics Corporation Philadelphia, Pennsylvania
80294	Bourns, Incorporated 6135 Magnolia Avenue Riverside, California
81349	Military Specifications Promulgated by Standardization Division Directorate of Logistic Services DSA, Washington, D. C.
91418	Radio Materials Corporation 4242 West Bryn Mawr Avenue Chicago 46, Illinois
91506	Augat, Incorporated 100 Perry Avenue Attleboro, Massachusetts
91662	Elco Corporation M Street Below Erie Avenue Philadelphia, Pennsylvania
99687	Raytheon Company 55 Chappel Street Newton, Massachusetts

5.4 PARTS LIST

When ordering replacement parts from CEI, specify the type and serial number of the equipment, and the reference designation and description of each part ordered. The Vendors and Vendor Part Numbers listed are included as a guide to the user of the equipment in the field and do not necessarily agree with the parts installed in the equipment. Except in thoses cases specifically noted, the replacement part may be obtained from any vendor as long as the physical and electrical parameters of the part selected agree with the original part.

NOTE

As improved semiconductors become available it is the policy of CEI to incorporate them in proprietary products. For this reason some transistors and diodes installed in an equipment may not agree with those specified in the parts lists and schematic diagrams of this manual. However, the semiconductors designated in the manual may be substituted in every case with satisfactory results.

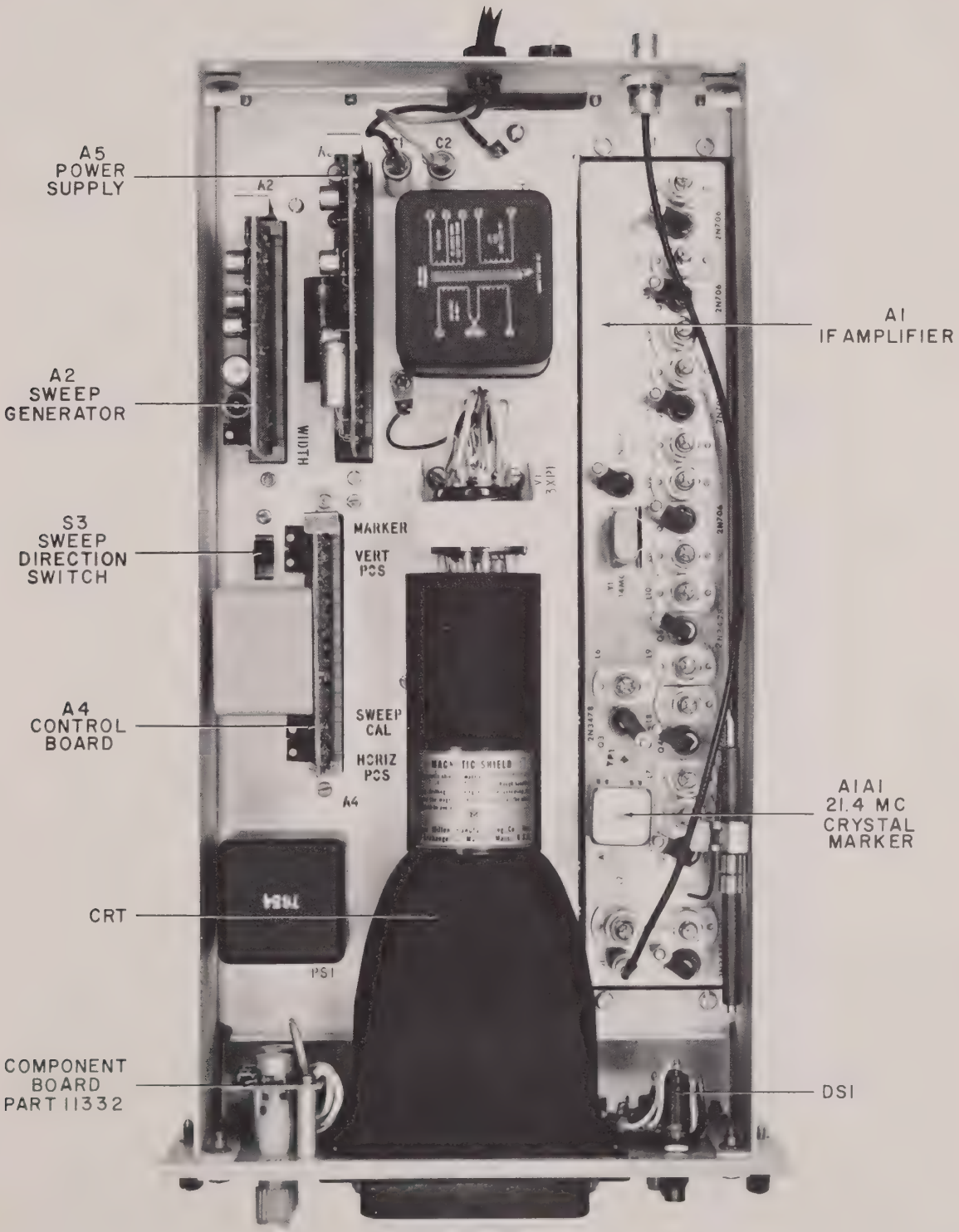


Figure 5-1. Type SM-9802B Signal Monitor, Top View

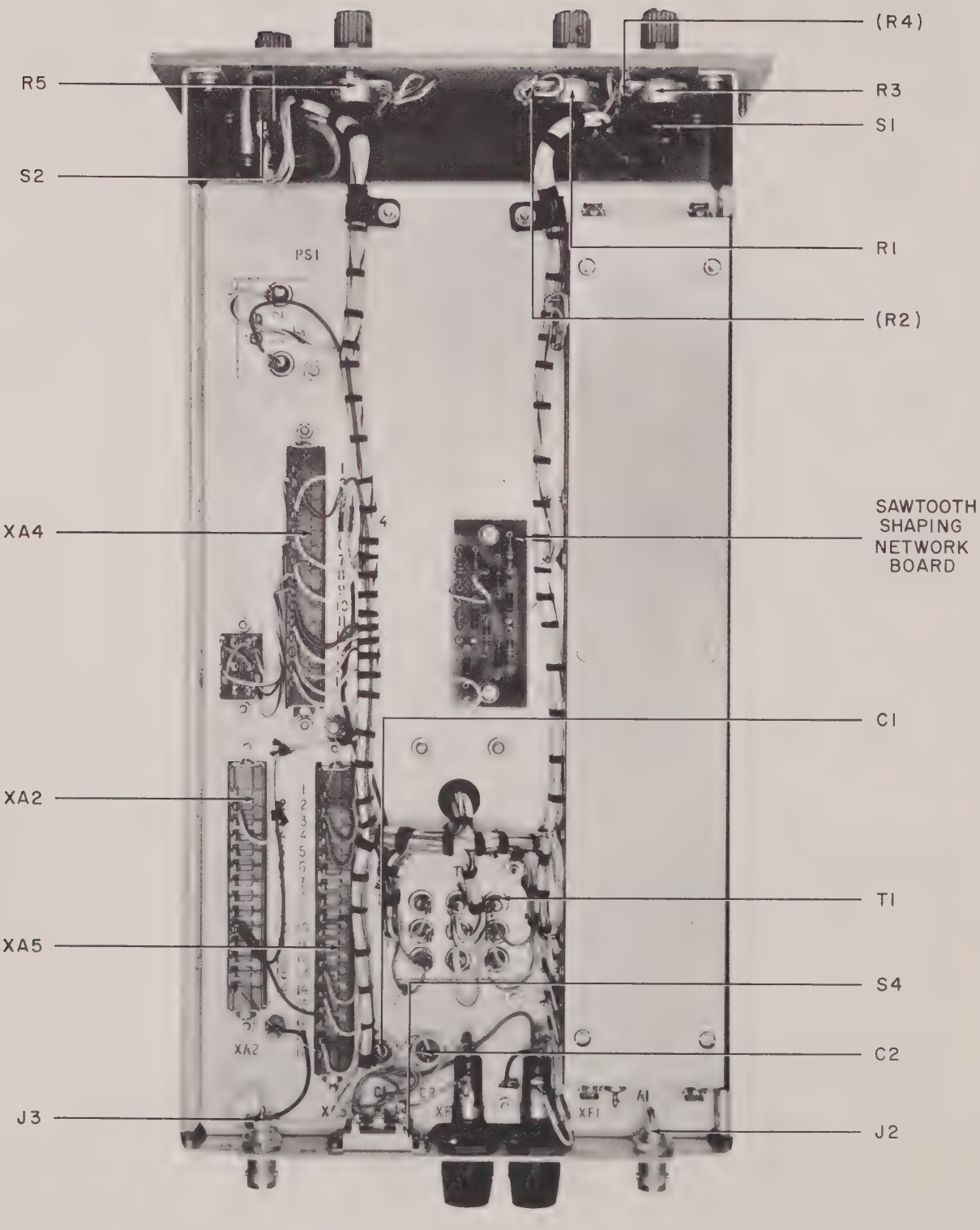


Figure 5-2. Type SM-9802B Signal Monitor, Bottom View

5.4.1 Types SM-9801A and SM-9802B Signal Monitors, Main Chassis

Ref. Desig.	Description	Qty. Per Unit	Vendor Part No.	Vendor Code
A1	IF AMPLIFIER	1	8112	14632
A2	SWEEP GENERATOR	1	8208	14632
A3	NOT USED			
A4	CONTROL BOARD	1	7959	14632
A5	POWER SUPPLY	1	7652	14632
C1	CAPACITOR, PAPER, THRU-PASS: .047 μf, 600V	2	102P20	56289
C2	Same as C1			
C3	NOT USED			
C4	CAPACITOR; CERAMIC DISC: .1 μf, +80 -20%, 100V	1	TA (.1 μf, Z)	91418
CR1	DIODE	5	1N462A	07688
CR2	Same as CR1			
CR3	Same as CR1			
CR4	Same as CR1			
CR5	Same as CR1			
CR6	DIODE	1	1N749A	07688
CR7	DIODE	1	1N751A	07688
DS1	LAMP, NEON	1	249-7841-1431	72619
F1	FUSE, SLOW-BLOW, 3AG, 1/16A	1	MDL-1/16	71400
F2	FUSE, SLOW-BLOW, 3AG, 1/32A	1	MDL-1/32	71400
J1	CONNECTOR, JACK, BNC, Part of W1	1	17825	74868
J2	CONNECTOR, RECEPTACLE, BNC	2	UG-1094/U	74868
J3	Same as J2			
P1	POWER CORD AND PLUG	1	01753-001	71700
P2	CONNECTOR, PLUG, MB SERIES, Part of W1	1	44950	74868
PS1	DC-DC CONVERTER	1	7654	14632
R1	RESISTOR, VARIABLE, COMPOSITION: 10K, 10%, 1/2W	2	LW23562	71450
R2	RESISTOR, FIXED, COMPOSITION: 47K, 5%, 1/4W	2	CB4735	01121
R3	Same as R1			
R4	RESISTOR, FIXED, COMPOSITION: 5.1K, 5%, 1/4W	1	CB5125	01121
R5	RESISTOR, VARIABLE, COMPOSITION: 50K, 10%, 1/2W	1	NX24430	71450

Ref. Desig.	Description	Qty. Per Unit	Vendor Part No.	Vendor Code
R6	RESISTOR, FIXED, COMPOSITION: 100K, 5%, 1/4W	4	CB1045	01121
R7	RESISTOR, VARIABLE, COMPOSITION: 500K, 10%, 1/4W	1	70-09172	76055
R8	RESISTOR, FIXED, COMPOSITION: 4.7M, 5%, 1/2W	1	EB4755	01121
R9	RESISTOR, VARIABLE, COMPOSITION: 2.5M, 10%, 1/4W	1	70-09173	76055
R10	RESISTOR, FIXED, COMPOSITION: 6.8M, 5%, 1/2W	2	EB6855	01121
R11	Same as R10			
R12	NOT USED			
R13	Same as R2			
R14	Same as R6			
R15	RESISTOR, FIXED, COMPOSITION: 240K, 5%, 1/4W	1	CB2445	01121
R16	Same as R6			
R17	Same as R6			
R18	RESISTOR, FIXED, COMPOSITION: 120K, 5%, 1/4W (Nominal Value)	1	CB1245	01121
R19	RESISTOR, FIXED, COMPOSITION: 150K, 5%, 1/4W (Nominal Value)	1	CB1545	01121
S1	SWITCH, TOGGLE, SPST	2	8280-K16	15605
S2	Same as S1			
S3	SWITCH, SLIDE, DPDT	1	G326	79727
S4	SWITCH, SLIDE, DPDT	1	4633	42190
T1	TRANSFORMER	1	11352	14632
V1	TUBE, CRT	1	3XP1	07688
W1	CABLE AND CONNECTOR ASSEMBLY	1	30020-307	14632
XA2	CONNECTOR, RECEPTACLE, PRINTED CIRCUIT	1	00-5002-014-103-002	91662
XA4	CONNECTOR, RECEPTACLE, PRINTED CIRCUIT	1	00-5002-015-103-002	91662
XA5	CONNECTOR, RECEPTACLE, PRINTED CIRCUIT	1	00-5002-018-103-002	91662
XF1	FUSEHOLDER	2	342004	75915
XF2	Same as XF1			
	HANDLES, FRONT (SM-9801A Only)	2	1252-1	71279
	HANDLES, REAR (SM-9801A Only)	2	1250-1	71279
	KNOBS (Gray)	5	G50-2-1	99687
	DUST COVER (Top) (SM-9801A Only)	1	20030-1	14632

Ref. Desig.	Description	Qty. Per Unit	Vendor Part No.	Vendor Code
	DUST COVER (Bottom) (SM-9801A Only)	1	20030-2	14632
	CLIP, PRINTED CIRCUIT RETAINER	3	12746	14632

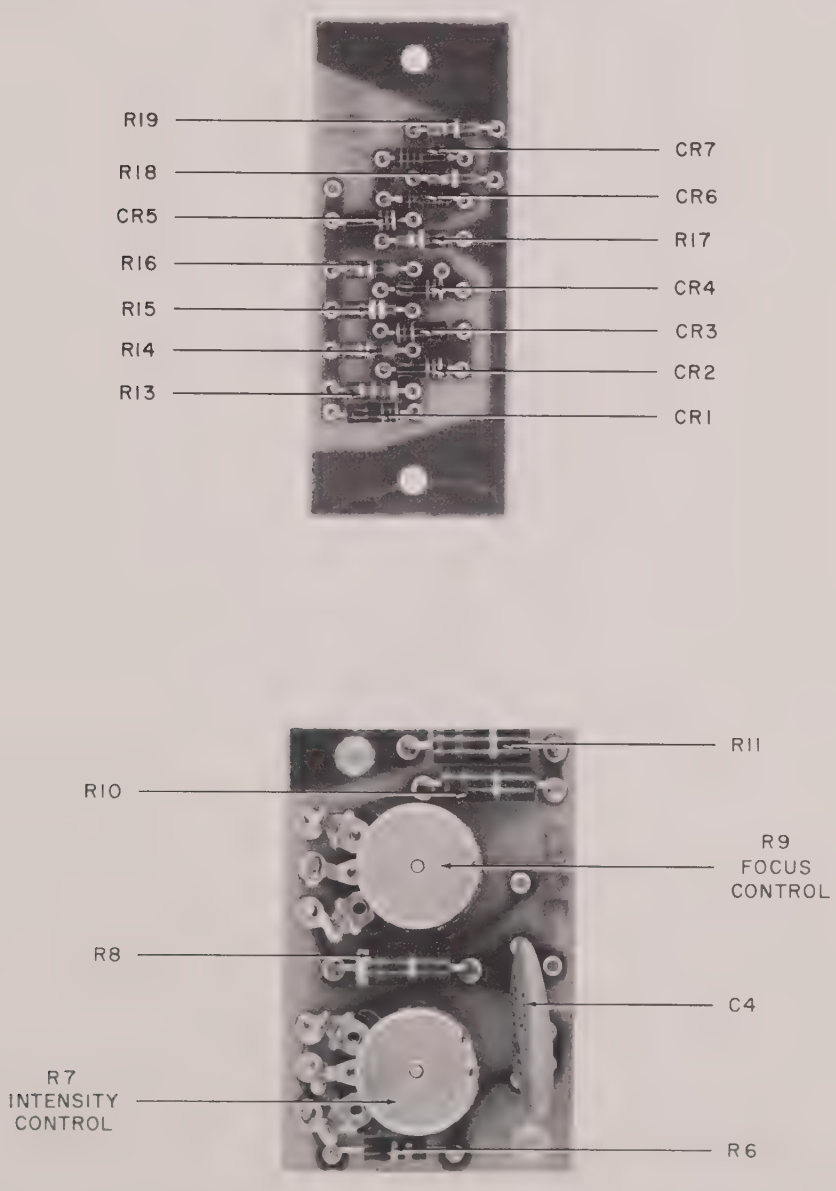


Figure 5-3. Sawtooth Shaping Network (top) and Component Board (Bottom), Component Locations

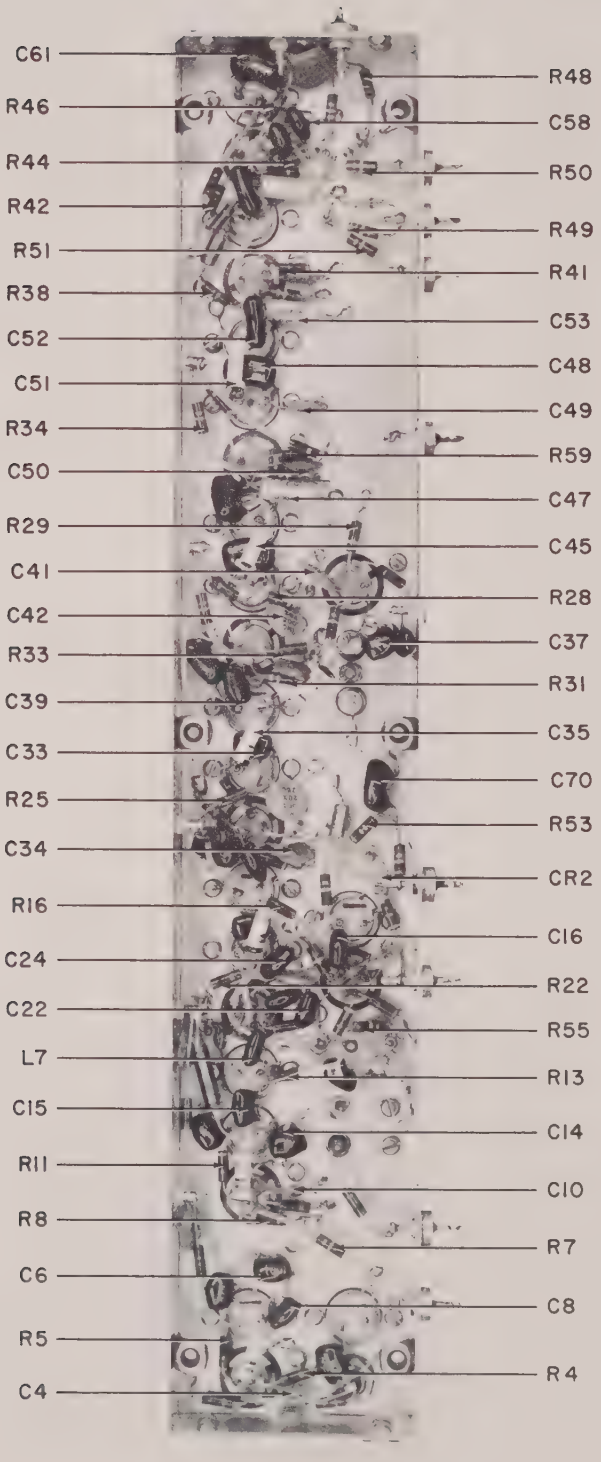


Figure 5-4. Type 8112 IF Amplifier Chassis, Component Locations

5.4.2 Type 8112 IF Amplifier

REF DESIG PREFIX A1

Ref. Desig.	Description	Qty. Per Unit	Vendor Part No.	Vendor Code
A1	CRYSTAL MARKER: 21.4 MC	1	11280-1	14632
C1	CAPACITOR, CERAMIC FEEDTHRU: 1000 pf, GMV, 500V	5	FA5C-102W	01121
C2	CAPACITOR, CERAMIC DISC: 1000 pf, GMV, 500V	3	SM (.001 μf, GMV)	91418
C3	CAPACITOR, CERAMIC TUBULAR: 1.0 pf, ±.25 pf, 500V	5	301-000-COKO-109C	72982
C4	Same as C2			
C5	CAPACITOR, DIPPED MICA: 47 pf, 5%, 500V	6	DM10-470J	72136
C6	CAPACITOR, DIPPED MICA: 100 pf, 5%, 500V	1	DM10-101J	72136
C7	CAPACITOR, CERAMIC DISC: .005 μf, 20%, 500V	8	SM (.005 μf, 20%)	91418
C8	Same as C5			
C9	Same as C3			
C10	Same as C2			
C11	Same as C3			
C12	NOT USED			
C13	CAPACITOR, DIPPED MICA: 30 pf, 5%, 500V	1	DM10-300J	72136
C14	CAPACITOR, DIPPED MICA: 20 pf, 5%, 500V	1	DM10-200J	72136
C15	CAPACITOR, DIPPED MICA: 22 pf, 5%, 500V	1	DM10-220J	72136
C16	CAPACITOR, DIPPED MICA: 130 pf, 5%, 500V	2	DM10-131J	72136
C17	Same as C1			
C18	Same as C16			
C19	Same as C7			
C20	CAPACITOR, DIPPED MICA: 15 pf, 5%, 500V	1	DM10-150J	72136
C21	CAPACITOR, DIPPED MICA: 82 pf, 5%, 500V	1	DM10-820J	72136
C22	CAPACITOR, CERAMIC DISC: 56 pf, 5%, 1000V (TC-N750)	1	10TCU-Q56	56289
C23	CAPACITOR, DIPPED MICA: 39 pf, 5%, 500V	1	DM10-390J	72136
C24	CAPACITOR, DIPPED MICA: 24 pf, 5%, 500V	1	DM10-240J	72136
C25	Same as C7			
C26	Same as C7			
C27	CAPACITOR, DIPPED MICA: 75 pf, 5%, 500V	4	DM10-750J	72136
C28	Same as C3			
C29	Same as C27			
C30	CAPACITOR, DIPPED MICA: 560 pf, 5%, 300V	1	DM15-561J	72136

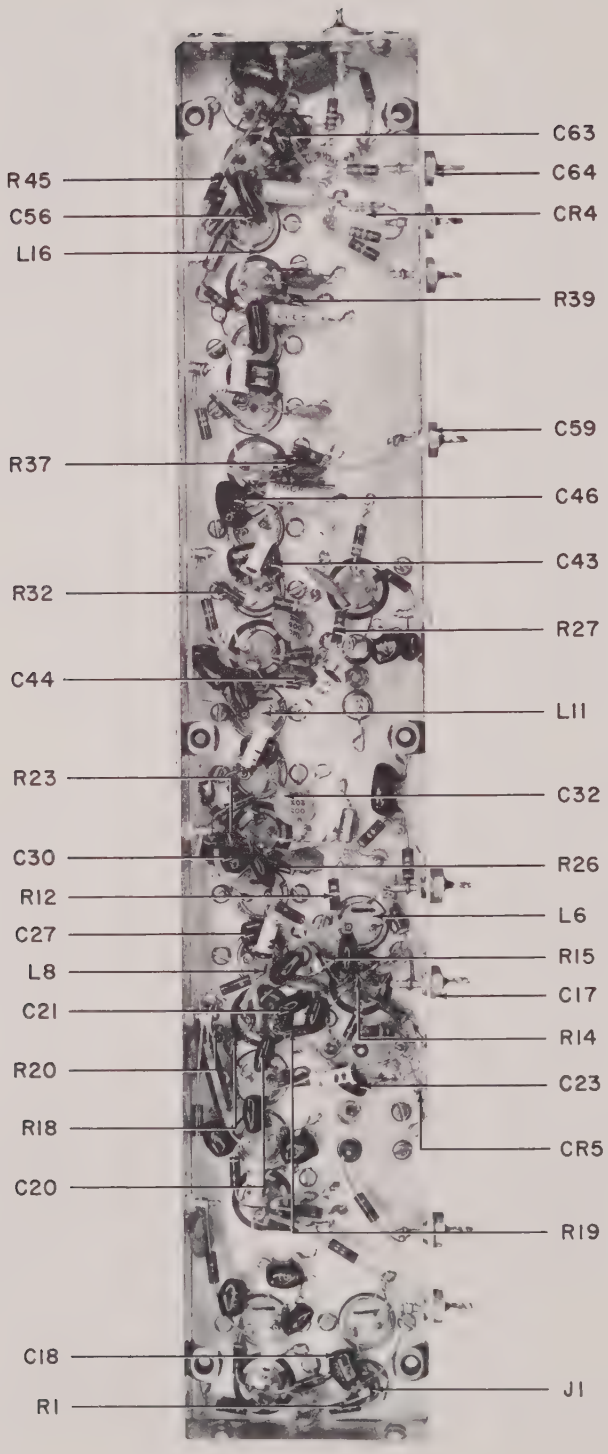


Figure 5-5. Type 8112 IF Amplifier Chassis, Component Locations

Ref. Desig.	Description	Qty. Per Unit	Vendor Part No.	Vendor Code
C31	Same as C1			
C32	Same as C7			
C33	Same as C27			
C34	CAPACITOR, CERAMIC DISC: .01 μf, 20%, 50V	4	19C214A6	56289
C35	Same as C3			
C36	CAPACITOR, CERAMIC TUBULAR: 2.2 pf, ±.25 pf, 500V	1	301-000-COJO-229C	72982
C37	Same as C5			
C38	Same as C5			
C39	Same as C27			
C40	CAPACITOR, DIPPED MICA: 510 pf, 5%, 500V	1	DM15-511J	72136
C41	Same as C7			
C42	Same as C7			
C43	CAPACITOR, DIPPED MICA: 620 pf, 5%, 500V	5	DM15-621J	72136
C44	Same as C34			
C45	CAPACITOR, CERAMIC TUBULAR: 4.3 pf, ±.25 pf, 500V	2	301-000-COHO-439C	72982
C46	Same as C43			
C47	CAPACITOR, MYLAR TUBULAR: .0068 μf, 10%, 100V	3	61F10AA682	06001
C48	Same as C43			
C49	Same as C7			
C50	Same as C34			
C51	Same as C45			
C52	Same as C43			
C53	Same as C47			
C54	CAPACITOR, ELECTROLYTIC, TANTALUM: 1 μf, 10%, 35V	3	150D105X9035A2	56289
C55	Same as C34			
C56	Same as C43			
C57	Same as C47			
C58	Same as C54			
C59	Same as C1			
C60	CAPACITOR, CERAMIC DISC: .05 μf, 20%, 50V	1	55C23A1	56289
C61	CAPACITOR, DIPPED MICA: 270 pf, 5%, 500V	1	DM15-271J	72136
C62	Same as C5			

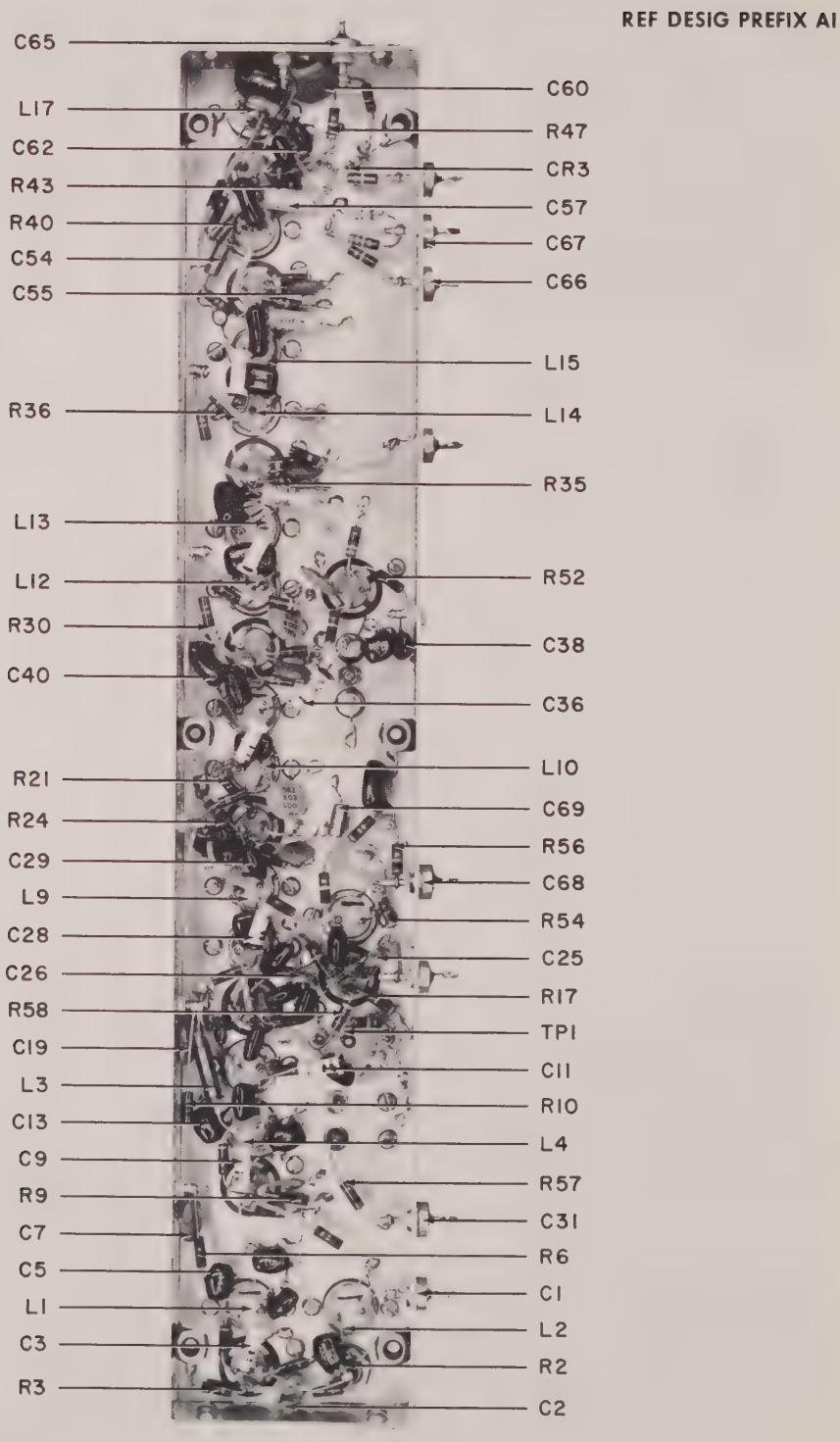


Figure 5-6. Type 8112 IF Amplifier Chassis, Component Locations

Ref. Desig.	Description	Qty. Per Unit	Vendor Part No.	Vendor Code
C63	Same as C5			
C64	CAPACITOR, CERAMIC FEEDTHRU: 33 pf, 10%, 500V	2	FA5C-3301	01121
C65	CAPACITOR, CERAMIC FEEDTHRU: 330 pf, 10%, 500V	2	FA5C-3311	01121
C66	Same as C64			
C67	Same as C1			
C68	Same as C65			
C69	Same as C54			
C70	CAPACITOR, DIPPED MICA: 330 pf, 5%, 500V	1	DM15-331J	72136
CR1	NOT USED			
CR2	DIODE, CAPACITOR	1	V27E	01281
CR3	DIODE	3	1N198	07688
CR4	Same as CR3			
CR5	Same as CR3			
J1	CONNECTOR, RECEPTACLE, MB SERIES	1	46025	74868
L1	COIL, VARIABLE	8	1472-3	14632
L2	COIL, VARIABLE	1	1472-2	14632
L3	COIL, FIXED	1	1131-37	14632
L4	Same as L1			
L5	NOT USED			
L6	Same as L1			
L7	Same as L1			
L8	Same as L1			
L9	Same as L1			
L10	Same as L1			
L11	Same as L1			
L12	COIL, VARIABLE	5	1472-7	14632
L13	Same as L12			
L14	Same as L12			
L15	Same as L12			
L16	Same as L12			
L17	COIL, VARIABLE	1	1472-20	14632
Q1	TRANSISTOR	4	2N3478	07688
Q2	Same as Q1			
Q3	Same as Q1			
Q4	TRANSISTOR	1	2N3823	07688

Ref. Desig.	Description	Qty. Per Unit	Vendor Part No.	Vendor Code
Q5	Same as Q1			
Q6	TRANSISTOR	5	2N706	07688
Q7	Same as Q6			
Q8	Same as Q6			
Q9	Same as Q6			
Q10	Same as Q6			
R1	RESISTOR, FIXED, COMPOSITION: 51Ω, 5%, 1/4W	1	CB5105	01121
R2	RESISTOR, FIXED, COMPOSITION: 22K, 5%, 1/4W	2	CB2235	01121
R3	RESISTOR, FIXED, COMPOSITION: 5.1K, 5%, 1/4W	2	CB5125	01121
R4	RESISTOR, FIXED, COMPOSITION: 1K, 5%, 1/4W	5	CB1025	01121
R5	RESISTOR, FIXED, COMPOSITION: 47Ω, 5%, 1/4W	4	CB4705	01121
R6	RESISTOR, FIXED, COMPOSITION: 620Ω, 5%, 1/4W	1	CB6215	01121
R7	Same as R2			
R8	Same as R3			
R9	Same as R4			
R10	Same as R4			
R11	Same as R5			
R12	RESISTOR, FIXED, COMPOSITION: 220K, 5%, 1/4W	3	CB2245	01121
R13	RESISTOR, FIXED, COMPOSITION: 1.6K, 5%, 1/4W	1	CB1625	01121
R14	RESISTOR, FIXED, COMPOSITION: 82K, 5%, 1/4W	1	CB8235	01121
R15	RESISTOR, FIXED, COMPOSITION: 100K, 5%, 1/4W	5	CB1045	01121
R16	Same as R4			
R17	RESISTOR, FIXED, COMPOSITION: 4.7K, 5%, 1/4W	3	CB4725	01121
R18	RESISTOR, FIXED, COMPOSITION: 330K, 5%, 1/4W	3	CB3345	01121
R19	RESISTOR, FIXED, COMPOSITION: 2K, 5%, 1/4W	1	CB2025	01121
R20	Same as R15			
R21	Same as R5			

Ref. Desig.	Description	Qty. Per Unit	Vendor Part No.	Vendor Code
R22	Same as R4			
R23	RESISTOR, FIXED, COMPOSITION: 27K, 5%, 1/4W	4	CB2735	01121
R24	RESISTOR, FIXED, COMPOSITION: 10K, 5%, 1/4W	5	CB1035	01121
R25	RESISTOR, FIXED, COMPOSITION: 2.7K, 5%, 1/4W	4	CB2725	01121
R26	RESISTOR, FIXED, COMPOSITION: 4.7K, 5%, 1/4W	1	CB4725	01121
R27	RESISTOR, FIXED, COMPOSITION: 200K, 5%, 1/4W	1	CB2045	01121
R28	RESISTOR, FIXED, COMPOSITION: 3.9K, 5%, 1/4W	2	CB3925	01121
R29	Same as R28			
R30	Same as R23			
R31	Same as R24			
R32	Same as R25			
R33	Same as R17			
R34	Same as R23			
R35	Same as R24			
R36	Same as R25			
R37	Same as R17			
R38	Same as R23			
R39	Same as R24			
R40	Same as R25			
R41	Same as R17			
R42	RESISTOR, FIXED, COMPOSITION: 7.5K, 5%, 1/4W	1	CB7525	01121
R43	RESISTOR, FIXED, COMPOSITION: 2.2K, 5%, 1/4W	1	CB2225	01121
R44	RESISTOR, FIXED, COMPOSITION: 330Ω, 5%, 1/4W	1	CB3315	01121
R45	RESISTOR, FIXED, COMPOSITION: 100Ω, 5%, 1/4W	2	CB1015	01121
R46	RESISTOR, FIXED, COMPOSITION: 10Ω, 5%, 1/4W	2	CB1005	01121
R47	Same as R18			
R48	RESISTOR, FIXED, COMPOSITION: 33K, 5%, 1/4W	1	CB3335	01121
R49	Same as R18			

Ref. Desig.	Description	Qty. Per Unit	Vendor Part No.	Vendor Code
R50	Same as R12			
R51	Same as R12			
R52	RESISTOR, FIXED, COMPOSITION: 220Ω, 5%, 1/4W	1	CB2215	01121
R53	RESISTOR, FIXED, COMPOSITION: 3.0Ω, 5%, 1/4W	1	CB30G5	01121
R54	RESISTOR, FIXED, COMPOSITION: 47K, 5%, 1/4W	1	CB4735	01121
R55	Same as R15			
R56	RESISTOR, FIXED, COMPOSITION: 30K, 5%, 1/4W	1	CB3035	01121
R57	Same as R45			
R58	Same as R5			
R59	Same as R46			
TP1	TEST POINT	1	TJ-6	04013
Y1	CRYSTAL, QUARTZ: 14.000 MC	1	CR-18/U	81349
XY1	CRYSTAL SOCKET ASSEMBLY	1	8000-AG2	91506
	IF CHASSIS COVER	1	2997	14632

5.4.2.1 Part 11280 21.4-MC Crystal Marker

REF DESIG PREFIX A1A1

Ref. Desig.	Description	Qty. Per Unit	Vendor Part No.	Vendor Code
C1	CAPACITOR, DIPPED MICA: 68 pf, 5%, 500V	1	DM10-680J	72136
C2	CAPACITOR, CERAMIC FEEDTHRU: 1000 pf, GMV, 500V	1	FA5C-102W	01121
C3	CAPACITOR, DIPPED MICA: 43 pf, 5%, 500V	1	DM10-430J	72136
C4	CAPACITOR, CERAMIC DISC: 470 pf, 20%, 1000V	1	B	91418
C5	CAPACITOR, COMPOSITION, TUBULAR: 1.0 pf, 10%, 500V	1	QC	95121
E1	TERMINAL, FEEDTHRU	1	SFU-16	04013
Q1	TRANSISTOR	1	2N706	07688
R1	RESISTOR, FIXED, COMPOSITION: 470K, 5%, 1/4W	1	CB4745	01121
R2	RESISTOR, FIXED, COMPOSITION: 10K, 5%, 1/4W	1	CB1035	01121
Y1	CRYSTAL, QUARTZ: 21.4 MC, Except W/Wire Leads	1	CR-78/U	74306

REF DESIG PREFIX A1A1

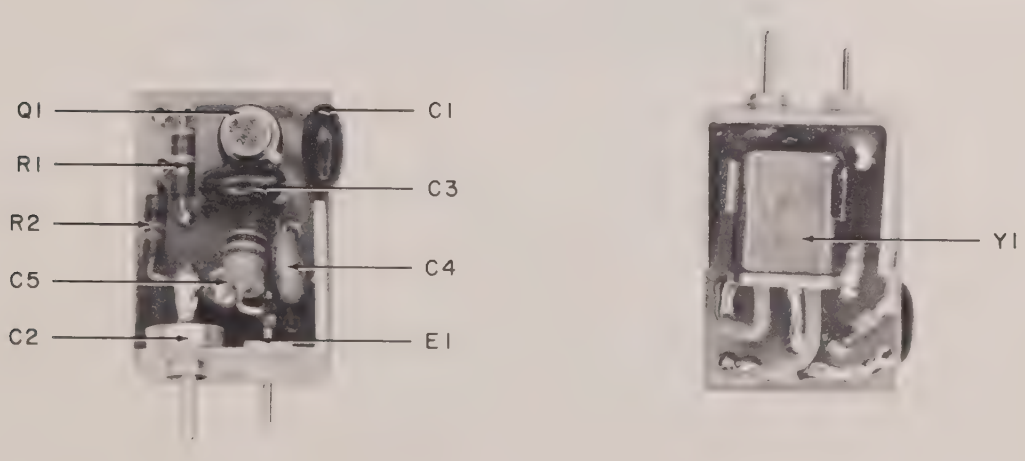


Figure 5-7. 21.4 mc Crystal Marker Oscillator Assembly, Component Locations

REF DESIG PREFIX A2

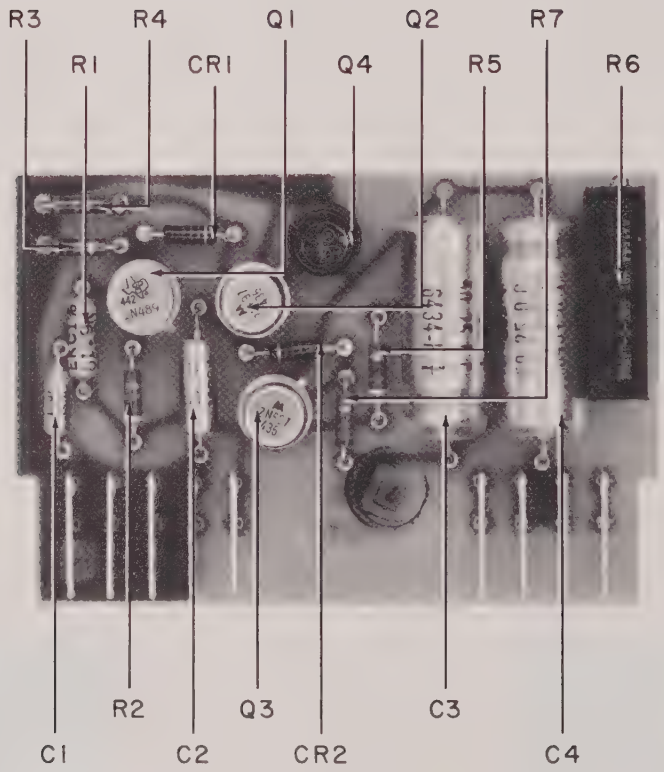


Figure 5-8. Type 8208 Sweep Generator Module, Component Locations

5.4.3 Type 8208 Sweep Generator

REF DESIG PREFIX A2

Ref. Desig.	Description	Qty. Per Unit	Vendor Part No.	Vendor Code
C1	CAPACITOR, ELECTROLYTIC: 1 μf, 10%, 35V	1	150D105X9035A2	56289
C2	CAPACITOR, ELECTROLYTIC: 2.2 μf, 10%, 35V	1	150D225X9035B2	56289
C3	CAPACITOR, ELECTROLYTIC: 50 μf, -10 +75%, 25V	2	30D506G025DD4	56289
C4	Same as C3			
CR1	DIODE	2	1N462A	07688
CR2	Same as CR1			
Q1	TRANSISTOR	1	2N489	07688
Q2	TRANSISTOR	2	2N697	07688
Q3	Same as Q2			
Q4	TRANSISTOR	1	2N1925	07688
R1	RESISTOR, FIXED, FILM: 61.9K, 1%, 1/4W	1	RN60D6192F	81349
R2	RESISTOR, FIXED, COMPOSITION: 470Ω, 5%, 1/4W	1	CB4715	01121
R3	RESISTOR, FIXED, COMPOSITION: 100Ω, 5%, 1/4W	1	CB1015	01121
R4	RESISTOR, FIXED, COMPOSITION: 820Ω, 5%, 1/4W	1	CB8215	01121
R5	RESISTOR, FIXED, COMPOSITION: 4.7K, 5%, 1/4W	1	CB4725	01121
R6	RESISTOR, VARIABLE, WIREWOUND: 10K, 10%, 1/2W	1	3067-P-1-103	80294
R7	RESISTOR, FIXED, COMPOSITION: 2.7K, 5%, 1/4W	1	CB2725	01121

REF DESIG PREFIX A4

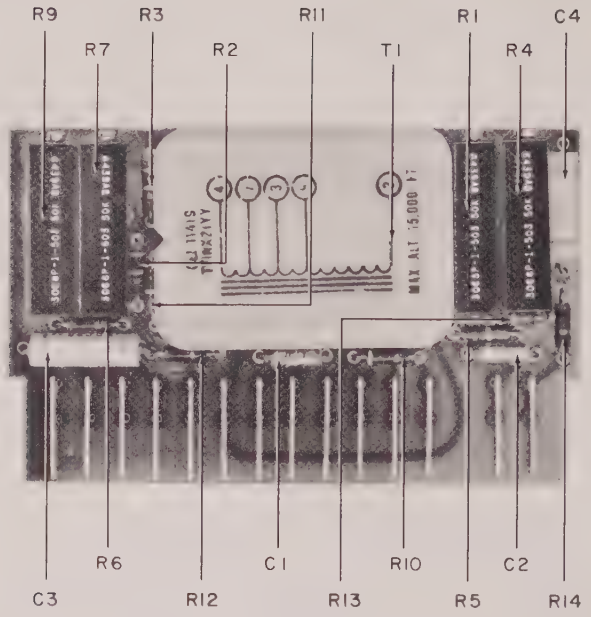


Figure 5-9. Type 7959 Control Board Module, Component Locations

REF DESIG PREFIX A5

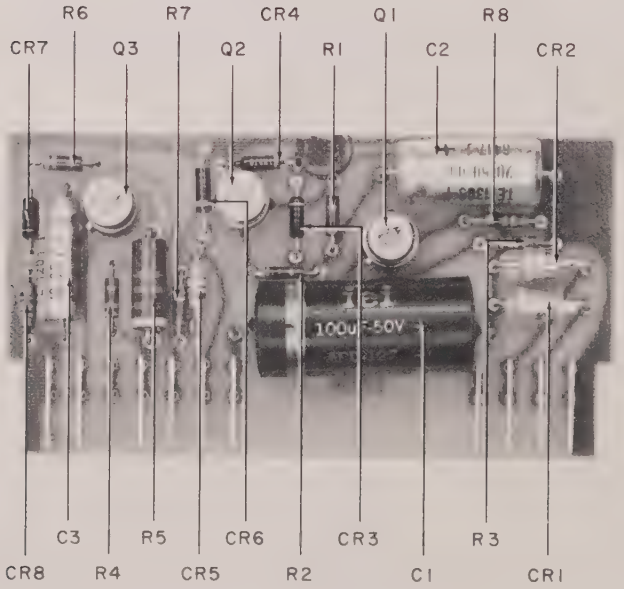


Figure 5-10. Type 7652 Power Supply Module, Component Locations

5.4.4 Type 7959 Control Board

REF DESIG PREFIX A4

Ref. Desig.	Description	Qty. Per Unit	Vendor Part No.	Vendor Code
C1	CAPACITOR, ELECTROLYTIC: 1 μf, 10%, 35V	2	150D105X9035A2	56289
C2	Same as C1			
C3	CAPACITOR, MYLAR, TUBULAR: .022 μf, 10%, 100V	2	663-UW	26655
C4	Same as C3			
R1	RESISTOR, VARIABLE, CARBON: 50K, 20%, .2W	4	3068-P-1-503	80294
R2	RESISTOR, FIXED, COMPOSITION: 470K, 5%, 1/4W	2	CB4745	01121
R3	Same as R2			
R4	Same as R1			
R5	RESISTOR, FIXED, COMPOSITION: 220K, 5%, 1/4W	3	CB2245	01121
R6	RESISTOR, FIXED, COMPOSITION: 1K, 5%, 1/4W	1	CB1025	01121
R7	Same as R1			
R8	NOT USED			
R9	Same as R1			
R10	RESISTOR, FIXED, COMPOSITION: 4.7K, 5%, 1/4W	1	CB4725	01121
R11	Same as R5			
R12	RESISTOR, FIXED, COMPOSITION: 1M, 5%, 1/4W	2	CB1055	01121
R13	Same as R5			
R14	Same as R12			
T1	TRANSFORMER	1	11419	14632

5.4.5 Type 7652 Power Supply

REF DESIG PREFIX A5

Ref. Desig.	Description	Qty. Per Unit	Vendor Part No.	Vendor Code
C1	CAPACITOR, ELECTROLYTIC: 100 μf, -10 +100%, 50V	1	APD127	02567
C2	CAPACITOR, ELECTROLYTIC: 20 μf, -10 +75%, 50V	1	30D206G050DC4	56289
C3	CAPACITOR, ELECTROLYTIC: 10 μf, -10 +75%, 25V	1	30D106G025BB4	56289
CR1	DIODE	2	1N3253	07688
CR2	Same as CR1			
CR3	DIODE	2	1N462A	07688
CR4	DIODE	1	1N970B	07688
CR5	DIODE	2	1N759A	07688
CR6	DIODE	1	1N753A	07688
CR7	Same as CR3			
CR8	Same as CR5			
Q1	TRANSISTOR	1	2N697	07688
Q2	TRANSISTOR	2	2N2270	07688
Q3	Same as Q2			
R1	RESISTOR, FIXED, COMPOSITION: 1K, 5%, 1/4W	2	CB1025	01121
R2	Same as R1			
R3	RESISTOR, FIXED, COMPOSITION: 6.8Ω, 5%, 1/4W	1	CB68G5	01121
R4	RESISTOR, FIXED, COMPOSITION: 3.3K, 5%, 1/4W	2	CB3325	01121
R5	RESISTOR, FIXED, COMPOSITION: 470Ω, 5%, 1W	1	GB4715	01121
R6	Same as R4			
R7	RESISTOR, FIXED, COMPOSITION: 3K, 5%, 1/4W	1	CB3025	01121
R8	RESISTOR, FIXED, COMPOSITION: 100Ω, 5%, 1/4W	1	CB1015	01121

SECTION VI

SCHEMATIC DIAGRAMS

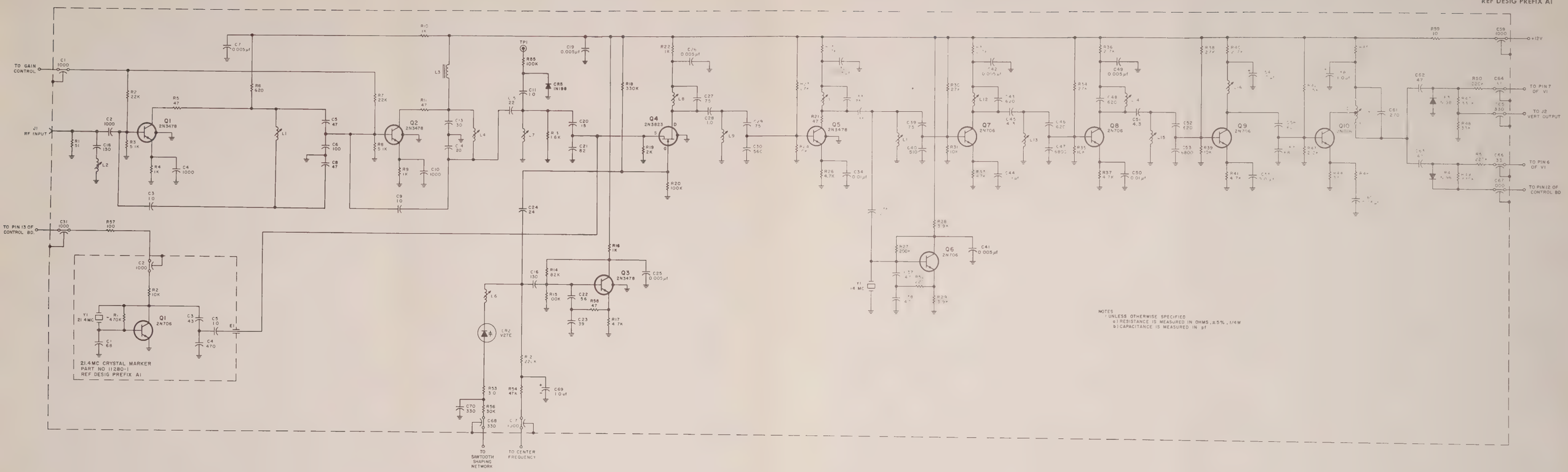
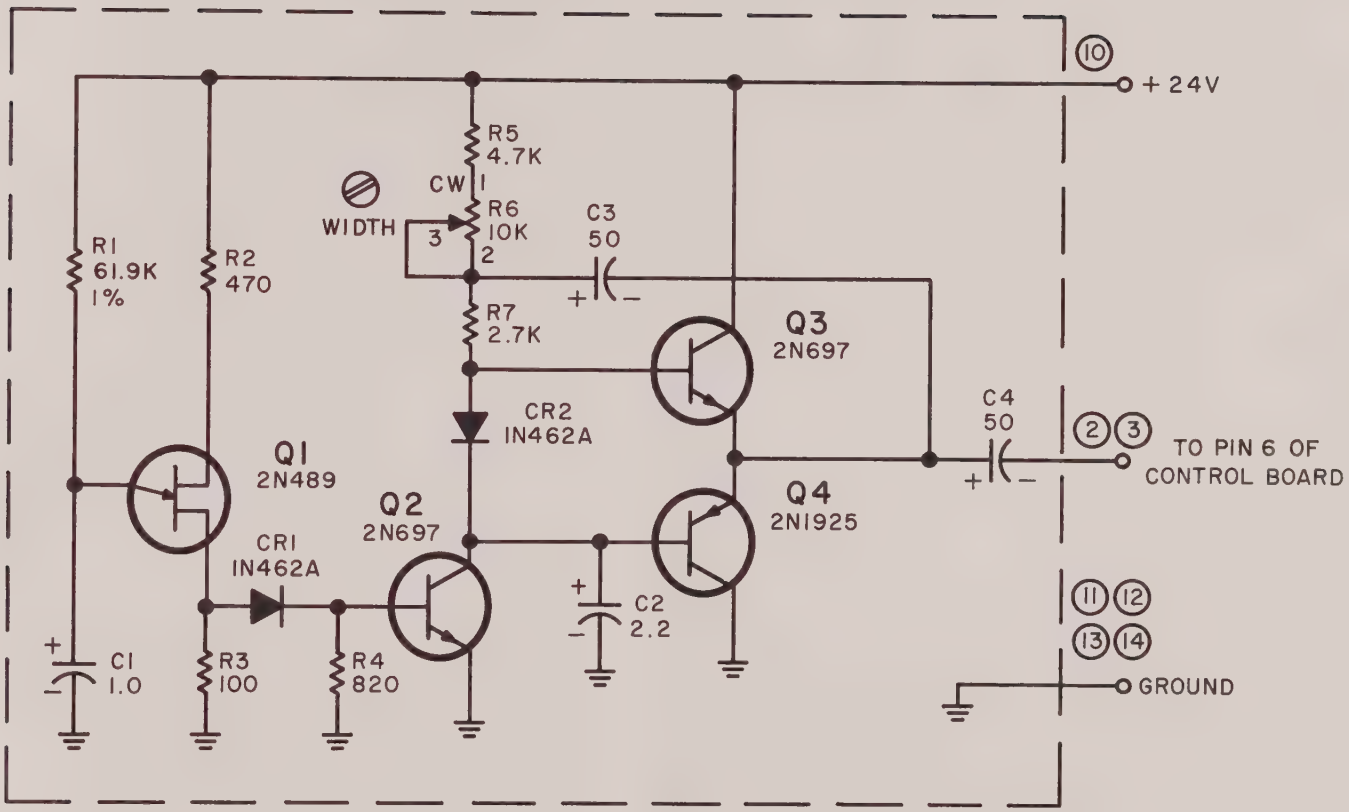


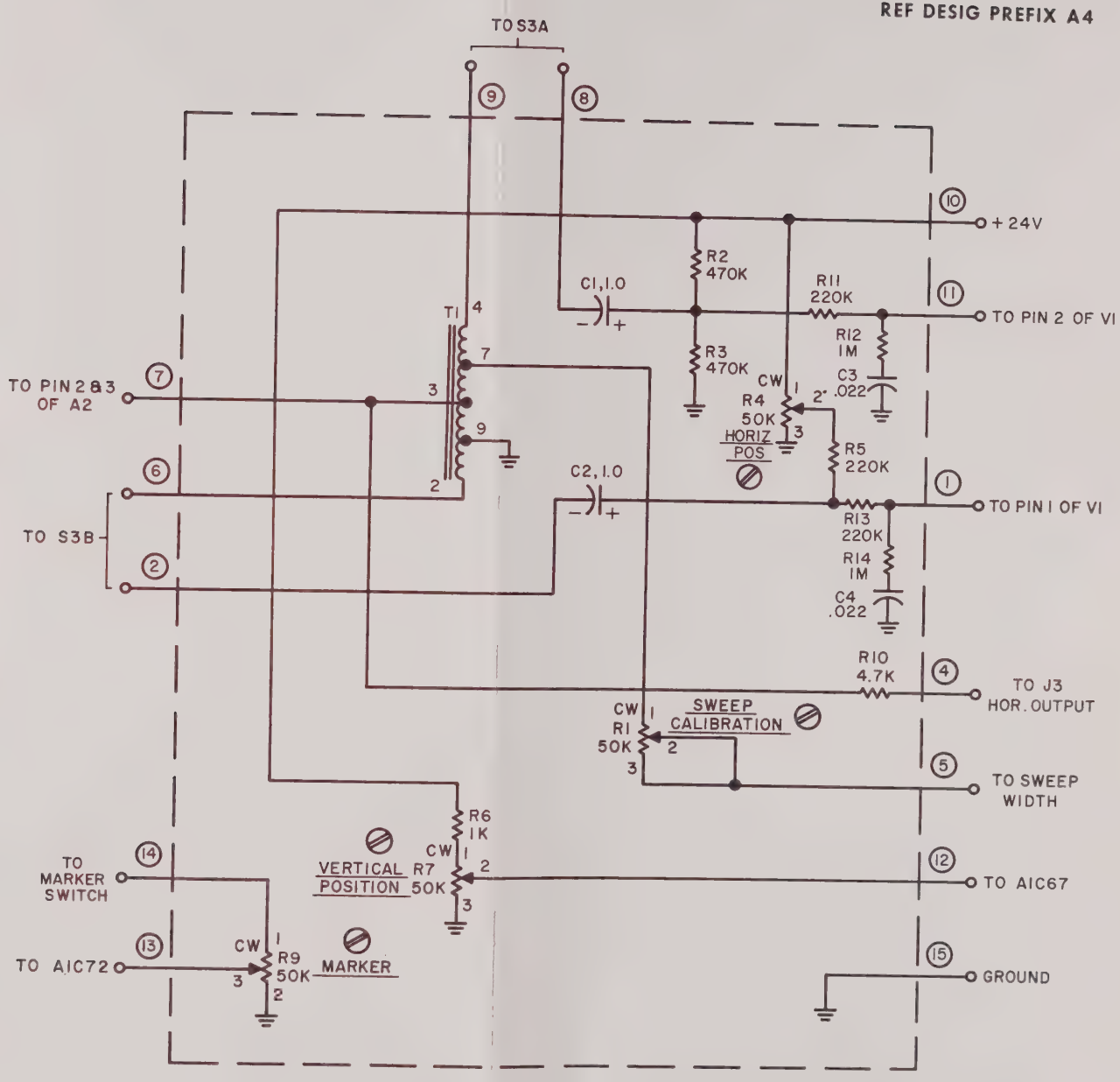
Figure 6-1. Type 8112 IF Amplifier, Schematic Diagram

REF DESIG PREFIX A2



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W
   b) CAPACITANCE IS MEASURED IN μf
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS
3. ⊘ INDICATES SCREWDRIVER ADJUSTMENT
4. CW INDICATES CLOCKWISE ROTATION OF CONTROL KNOB

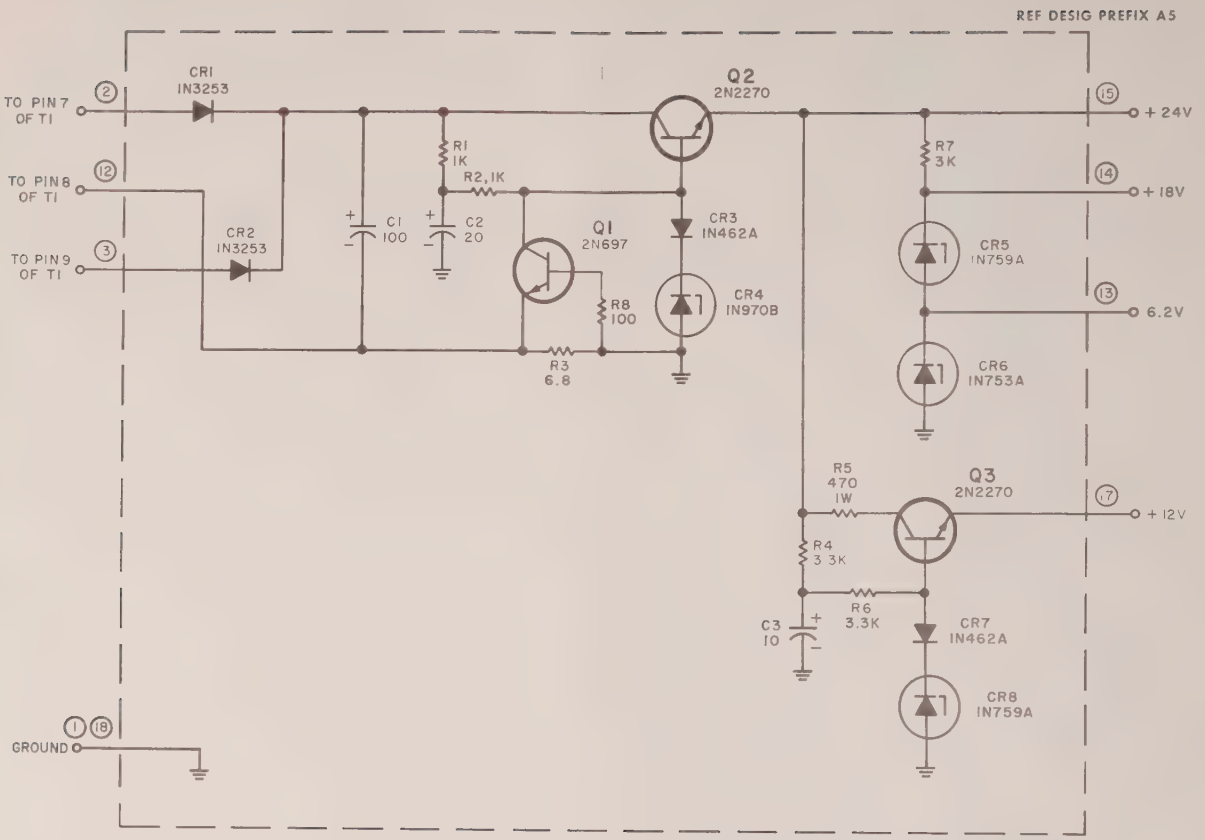
Figure 6-2. Type 8208 Sweep Generator, Schematic Diagram



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W
   b) CAPACITANCE IS MEASURED IN μf
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS
3. CW INDICATES CLOCKWISE ROTATION OF CONTROL KNOB
4. ⊘ INDICATES SCREWDRIVER ADJUSTMENT
5. VOLTAGES TAKEN WITH VTVM. CONTROLS SET FOR NORMAL OPERATION. VOLTAGES ARE DC MEASURED TO CHASSIS UNLESS OTHERWISE INDICATED.

Figure 6-3. Type 7959 Control Board, Schematic Diagram



NOTES.
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS MEASURED IN OHMS, ±5%, 1/4W
   b) CAPACITANCE IS MEASURED IN μf
2. ENCIRCLED NUMBERS ARE MODULE PIN NUMBERS

Figure 6-4. Type 7652 Power Supply, Schematic Diagram

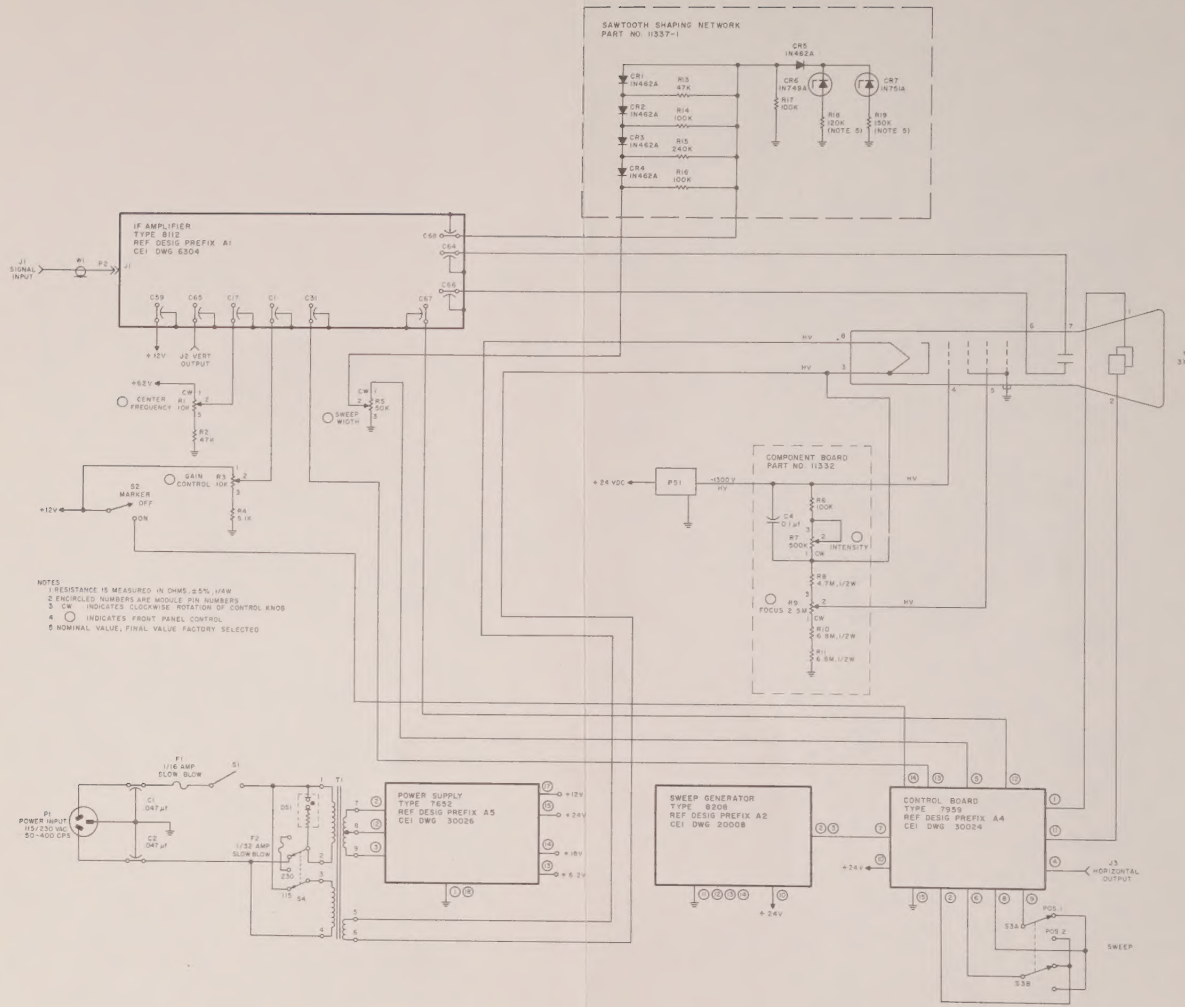


Figure 6-5. Types SM-9801A and SM-9802B Signal Monitors, Main Chassis Schematic Diagram